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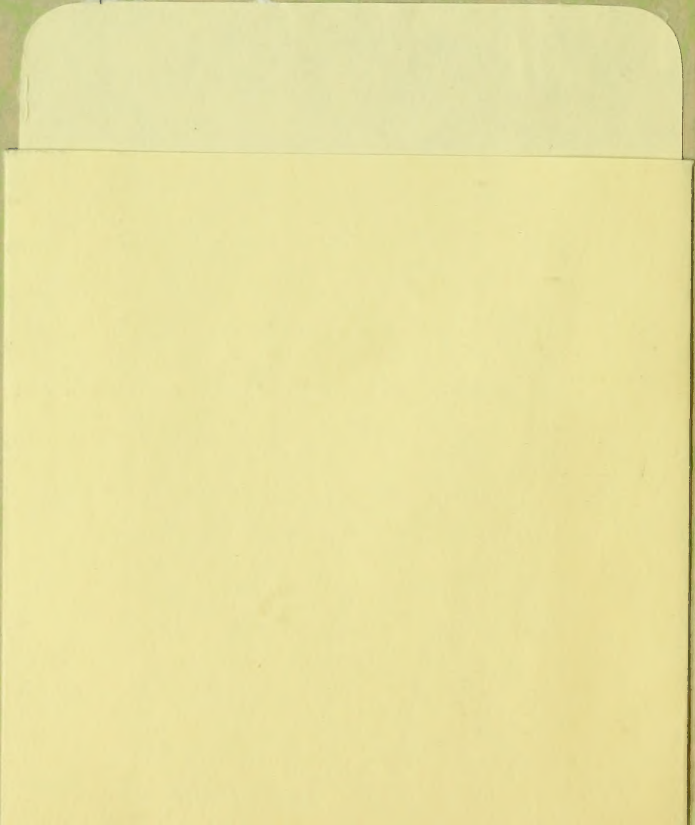


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Food Consumption of Boys and Girls
In
Six Typical Agricultural High Schools
of Mississippi



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In
Six Typical Agricultural High Schools
of Mississippi

By
DOROTHY DICKINS

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The findings presented here are based upon the data obtained from the observation of the food consumption of thirty-five boys and forty girls 15, 16, 17 and 18, 19 years of age in six typical agricultural high schools of Mississippi for a period of thirteen consecutive meals. These data are supplemented with information in regard to their height, weight, and activity.

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Food Consumption of Boys and Girls in Six Typical Agricultural High Schools of Mississippi

By
DOROTHY DICKINS

PURPOSE AND METHOD OF INVESTIGATION

This study is a part of a larger study on "Agricultural High School Dormitories of Mississippi" [6] conducted by the Home Economics Department of the Mississippi Experiment Station. It seeks to obtain a more accurate picture of food consumption in these institutions than is possible through a more general study. Such a picture, it was felt, would be of vital interest to Mississippi people as well as to the institutions concerned.

Choice of Schools:

Menus served on three successive school days in the winter session of 1929 were obtained from 40 of the 47 agricultural high schools. The following optimum score was used in grading these menus:

Optimum Score*		
Food	Standard	Optimum Score
Milk	1 qt. a day	24
Vegetables:		
Potato	Once a day	5
Other than potato or leafy	Once a day	10
Leafy	Four times a week	8
Fruit:		
Cooked	Once a day	7
Raw (or raw vegetable or canned tomato)	Twice a day	14
Bread and Cereals	Twice a day	14
Whole Grain		
(Eggs	Three times a week	9
(Meat	Once a day	9
		100
Coffee or Tea	deduct	10

*Esther Davies, 1928. "Food Consumption of Rural School Children in Relation to Their Health." Mass. Sta. Bul. 241, p. 105.

Table 1—Scores of Menus Served in 39 Agricultural High Schools of Mississippi on Three Successive School Days in the Winter Session of 1929.

Score	Number	Per Cent
35-44	5	12.8
45-54	10	25.6
55-64	17	43.6
65-75	7	18.0
Total	39	100.0

One school made a score of 90. This is not shown in Table 1, as it is so much out of line with the other scores. Scores of 39 schools ranged from 36 to 74 with an average of 57. Nearly one-half were in the 55 to 64 group. The general use of coffee and the limited use of whole grained cereals were the two factors which most often lowered the scores.

After the menus were graded, they were divided into three groups according to scores. The middle group contained menus from 14 schools, the other groups, menus from 13 schools. Two schools from each of these three groups were selected for making food consumption studies. The two schools from the first group, or those submitting the higher scoring menus will be termed A Schools, the two from the second group, or those submitting average scoring menus, will be termed B Schools, and the two from the third group, or those submitting lower scoring menus, will be termed C Schools. The menus from A Schools made an average score of 71; from B. Schools, an average score of 57; and C Schools, and average score of 43.

Two of the schools selected were located in North Mississippi, one in the Northeast Highland Area, the other in the Yazoo Basin Area; two in Central Mississippi, one in the Northeast Prairie Area, the other in the Shortleaf Pine Area; two in South Mississippi, one in the Brown Loam Area; and one in the Long Leaf Pine Area. No two schools belonging in the same group were located in the same section of the state.

The schools selected fed from 48 to 79 persons daily or an average of 66 persons. Only schools with a moderate number of boarders were selected, for it was impossible to get a sufficient number of subjects in small boarding departments, and impractical, considering equipment and labor involved, in larger boarding departments. All six schools selected for this study had matrons, three of whom were the superintendents' wives. Two of the matrons had attended a matrons' conference held at Mississippi State College for Women at Columbus, Mississippi in the summer of 1925. One had satisfactorily completed a correspondence course offered to institutional workers by the Mississippi Home Economics Association in 1928-29. The other three had had no home economics training.

Superintendents of the schools thus selected were informed that the college was making dietary studies in a number of agricultural high school dormitories and that their school was among those selected. In practically every instance, permission was readily obtained to conduct a study in any school desired. The successful completion of these studies was largely due to the splendid cooperation of the school officials.

Choice of Subjects:

Food consumption of boys and of girls 15-16-17 years of age in one school of each of the three adequacy types and of boys and girls 18-19 years of age in the other school of each of the three adequacy types was studied. These are the age groups generally found in agricultural high school dormitories in Mississippi.

Boys and girls who seemed to be among the most normal, healthy, and well-nourished in these schools were selected for this study. The criteria used in judging their condition was two-fold: the relation of weight to height and age, and a critical inspection by the investigator. Physical examinations were not made.

All dormitory students in age groups to be studied were weighed and measured. The measurement of height was made by having the child remove his shoes. All weighings were taken with the shoes and outer garments removed. The same scales were used in all but one school, the school scales being used in this case. The height and weight table used as a standard for 15-16-17-18 year old boys and girls was that prepared by Dr. Thomas D. Wood, the one for 19 year old boys and girls was that prepared by the Metropolitan Life Insurance Company. Only children of not more than 10 per cent below standard of weight for height or 20 per cent above standard of weight for height were selected for the study. Tables A, B, C, in the Appendix give age, height, and weight of each of the 75 children chosen as well as a comparison with the standard of weight for height. Table 2 gives the age and number of boys and girls selected in the three types of schools studied.

Table 2—Age and Number of Boys and Girls Selected for Food Consumption Study in Three Types of Agricultural High Schools of Mississippi.

AGE years	A SCHOOLS		B SCHOOLS		C SCHOOLS		TOTAL	
	boys	girls	boys	girls	boys	girls	boys	girls
15 and under 16.....	1	1	2	1	0	2	3	4
16 and under 17	3	2	4	5	1	2	8	9
17 and under 18	2	4	1	3	4	4	7	11
18 and under 19	3	2	3	4	2	5	8	11
19 and under 20	2	1	2	2	5	2	9	5
Total	11	10	12	15	12	15	35	40

It was the first year in the dormitory for 40 per cent of the children in the study, the second year for 39 per cent. This means that only one-fifth of these boys and girls had boarded in the dormitory over two years.

A record of activities during one school day was obtained from the 75 boys and girls studied (see form in Appendix). Average time expenditure for this group is shown in Fig. 1. Time expenditure of the group agrees rather closely with time expenditure of the 738 boys and girls previously studied [6], thereby showing that a representative group as far as activity is concerned had been selected. Boys and girls in this study spent a little more time in active outdoor exercise and a little less in study and reading than did the 738 boys and girls mentioned above. The difference in season, however, probably accounts for this, the 738 records being for the most part, collected in winter, these in the spring.

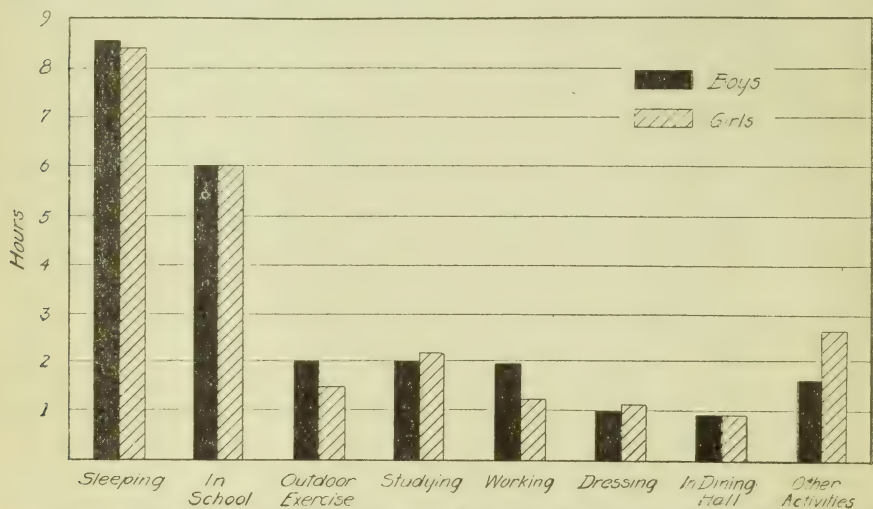


Fig. 1—Average Amount of Time Spent by Boys and Girls in One Typical School Day in Sleeping, in School, in Outdoor Exercise, in Studying and Reading, in Working, in Dressing, in the Dining Hall, and in Other Activities.

The only difference in activities of the boys and girls in this study was in time spent in outdoor exercise and in work, the boys spending more time than the girls. On the other hand, the girls used more time in talking with friends, listening to phonograph, and the like listed in Fig. 1 as "Other Activities."

Presenting the Study to Subjects Selected:

The boys and girls selected for the study were called together. They were told that the Home Economics Department of the Mississippi Experiment Station was making a study of food consumption in agricultural high schools of Mississippi, that their agricultural high school had been selected for one of these

studies, and that they, namely, this group, had been chosen out of all the dormitory pupils to be in this study. All that would be required of them was to sit at a different table in the dining room for the next 13 meals. There would be two tables for those in the study; one for the boys on which they would find the gold-band serving dishes, and one for the girls on which they would find the flowered serving dishes. Exactly the same food would be served them during this study as was served the other students in the dining hall. All food, however, put on each of these two tables would be weighed and all food left on plates or serving dishes would also be weighed. Thus a record of the amount of food consumed by the group of boys and the group of girls in this study would be obtained. Foods would be weighed in the kitchen and meal service would in no way be interrupted. All that was asked of them was to eat as usual, for if they changed their habits during this study, that is, ate more or less than usual, the study would be of no value. Any student who did not wish to be in this study was given a chance to withdraw. In no instance did one withdraw, or did one fail to show full cooperation.

Choice of Time:

All six studies were conducted in the spring, two in the spring of 1929 and the other four in the spring of 1930. If a study in one of the A Schools was conducted in early March, the study in the other A School was conducted in the latter part of April, that is, every effort was made to eliminate the seasonal factor, and to put the schools on a comparative basis.

Method of Collecting Data:

To collect the data on food consumption, the investigator visited six institutions, two each of three adequacy types, and weighed all food eaten by a selected group of boys and of girls from Monday supper through Friday supper, or for 13 consecutive meals. All ready-to-eat food was weighed in advance in order to save time at the serving of the meal. Separate ingredients of all prepared dishes were weighed before cooking. The cooked product was also weighed. Any fat lost in the cooking was determined. The food value of each recipe was calculated per ounce of the finished product. All food as it was portioned out for each table was weighed in the kitchen. The unused food was grouped after each meal as left overs or plate scraps and was weighed and subtracted from the amount of the food sent to the table. A record was kept of all foods furnished by the farm and the cost of all food purchased. Tea, coffee, condiments, and such foods as have no food value, were not considered.

The boys in the age group to be studied were seated at one

table, the girls at another. Each table had a special waitress. The serving dishes on the two tables were entirely different. In this way the danger of confusing in the meal time rush foods intended for boys with those intended for girls or vice versa was eliminated.

The fact that all six studies were satisfactorily completed without a single delay in meal service can be attributed to a number of things. In the first place, the investigator lived in the dormitory during the entire study and came to the kitchen with the cooks, in one case as early as 4:30 A. M. and left with them usually around 7:00 P. M. She was given the fullest cooperation by kitchen help. After the first meal or two she rarely had to remind them that she wanted to weigh the sugar and flour and so on. Two girls were employed in every school to help with the study, that is, to set the table, put food on table, serve, help supervise, check up at end of meal (plate scraps and food left in serving dishes), clear table, and wash dishes. In this way regular waitresses were not delayed because of the study. Platform and spring scales, serving dishes, and tins for collection of scraps were furnished by the department.

Four note books were used for recording data. The first was the "Kitchen Book." In this a record of all prepared foods was kept. The next two were the "Boys' Book," and the "Girls' Book." In these a record of ready-prepared foods, plate scraps, and foods left in serving dishes was kept. These three books were checked over after each meal and final results recorded into the fourth book termed the "Final Book." These books were worked up as far as possible before beginning a study.

Each day the boys and girls in the study were asked to give a record of all foods eaten between meals* on the previous day. Although this food was not weighed, these records are doubtless fairly accurate for many of the foods thus consumed were candy, salted peanuts, ice cream cones, bottled drinks, and the like, foods for which weights were readily obtained.

Method of Calculating Results:

Energy, protein, calcium, phosphorus, and iron content of food consumed by each group was computed, using in most instances the table for the nutritive value of foods in Sherman's "Chemistry of Food and Nutrition," [17-pp. 576-603] and in a few instances, the tables on the chemical composition of American food materials in Bulletin No. 28, U. S. Department of Agriculture, Office of Experiment Stations [2]. In the case of some ready prepared products eaten between meals, such as wafers, candy, ice cream cones, and ham sandwiches, figures computed

*There was no rule against eating between meals in any of these schools.

in Bulletin 242 of the New Hampshire Agricultural Experiment Station [3] were used.

Samples of such foods used as fresh fruits and vegetables, fruits and vegetables canned at the school, ready prepared foods, sorghum syrup, sugar cane syrup, and certain foods which had not had their nutritive value computed were collected. These with the exception of iron content, were analyzed by the Experiment Station Chemist, Mr. Marvin Gieger. The iron analyses were made by Misses Sheets and Frazier of the Home Economics Department of the Experiment Station. Costs of foods purchased were obtained from the matron or bookkeeper. As the price of food produced on the school farm, which was sold to the boarding department, varied with the individual school and as it was desired to put the money value of these diets on a comparative basis, all foods produced on school farms were valued at average wholesale prices.

Typicalness of Data Obtained:

In a study of this type, two factors are apt to enter in which will cause data to be anything but representative even when representative samples have been selected. These factors are, namely, a change in usual type of menu served at the school and a change in usual food consumption of boys and girls.

Before the study was started the matron was urged not to make any changes in the school menu during the study. This was easily checked as the investigator was thrown in constant contact with the boys and girls, teachers, and servants. From everything that could be learned, it seems that the meals were as usual during the study in five of the six schools. In one school, cocoa and preserves were substituted several times for milk and syrup. A more expensive meat was served at one meal than usual. These changes probably had more effect on the cost than on the energy and nutritive value of this dietary.

It was not possible to make many essential changes in the menu during this study for two reasons. In the first place, all the schools produced a part of their food on the school farm. All other foods were for the most part bought ahead of time in wholesale lots. This meant that there were certain foods available, study or no study. In the second place, board in these six schools ranged from \$9.00 to \$13.00 per month, only part of which went for food. This means that there was little money available for changes and especially changes when the school session, that is, checking up time, was so nearly out.

The studies were started at Monday supper. The consumption at this meal was not averaged in with the four day averages, that is, Tuesday, Wednesday, Thursday, and Friday averages.

It was thought advisable to allow one meal for the children to get used to the study. The boys and girls, however, seemed to take the study for granted even at the first meal. 15-16-17 year old boys averaged a total energy intake of 1592 calories for Monday night supper; 1469 calories for supper the other four nights; whereas, 15-16-17 year old girls averaged a total energy intake of 630 calories for Monday supper; 737 calories for supper the other four nights.

RESULTS OF THE STUDY

Energy and Nutritive Value of Food Served:

Although every effort was made to select normal weeks for these studies, the investigator found on her arrival at two schools that picnics had been planned. It would have been difficult to find a week especially in the spring when some extra-curricula activities were not going on.

She made no effort in these cases to have the picnics postponed, but carried the studies through as planned, except for Tuesday supper in one case, Wednesday supper in another, the meal of the picnic. At these meals, all foods to be used were weighed. The number of people served at each were recorded. From these figures average food consumption was obtained. These averages are probably fairly accurate as in all cases portions were divided equally and waste was nil. However, a picnic day cannot be considered typical. For that reason, three day instead of four day averages are given for these two schools.

In one of the A Schools, 18-19 year old boys and 15-16-17 year old girls were taken, in the other 15-16-17 year old boys and 18-19 year old girls. In the schools of the other two types, ages of boys and girls were not thus mixed.

Table 4—Average Daily Energy and Nutritive Value of Food Consumed by 15-16-17 Year Old Boys and Girls in Dining Halls of Three Types of Agricultural High Schools of Mississippi.

Groups	Average Energy and Nutritive Value per Person per Day				
	Energy calories	Protein grams	Calcium grams	Phosphorus grams	Iron grams
A School					
Boys	3224	97.2	1.578	2.459	.0138
Girls*	2340	59.5	.799	1.105	.0105
B School					
Boys	3516	94.4	1.190	1.776	.0230
Girls	2226	57.8	.782	1.093	.0140
C School					
Boys	3797	113.3	.870	1.423	.0246
Girls	2045	71.6	.513	.895	.0143
Average					
Boys	3512	101.6	1.213	1.886	.0205
Girls	2204	63.0	.698	1.031	.0129

*Three day instead of four day averages.

Table 5—Average Daily Energy and Nutritive Value of Food Consumed by 18-19 Year Old Boys and Girls in Dining Halls of Three Types of Agricultural High Schools of Mississippi.

Groups	Average Energy and Nutritive Value per Person per Day				
	Energy	Protein	Calcium	Phosphorus	Iron
	calories	grams	grams	grams	grams
A School					
Boys*	4235	116.3	2.106	2.355	.0212
Girls	2072	58.0	.820	1.247	.0096
B School					
Boys*	3493	91.3	1.135	1.567	.0192
Girls*	2178	57.2	.673	1.024	.0119
C School					
Boys	3790	85.8	.589	1.261	.0158
Girls	2533	63.0	.415	.891	.0121
Average					
Boys	3839	97.8	1.277	1.728	.0187
Girls	2261	59.4	.636	1.054	.0112

*Three day instead of four day averages.

A study of the variation of food consumption in the three types of schools selected as shown in Tables 4 and 5 indicates that the method of selection was good in two respects, namely, calcium and phosphorus. Calcium and phosphorus content of food consumed ran parallel with the scores of the menus submitted before the study began on which basis the schools were selected. The more generous use of cane syrup, a food rich in iron, by the low scoring schools explains the higher iron consumption in these schools. Cane syrup did not have a place on the score card on the basis of which the schools were grouped. There seemed to be no relation in type of school and energy and protein content of the diet.

Girls ate about 40 per cent less than boys. This was true of building and regulatory material as well as energy material. The calories the girls ate did not carry any more building and regulatory material than that of boys, in fact, less calcium in both age groups and less phosphorus in the 15-16-17 year age group than that of the boys. Mrs. Rose says, "It will cost just as much to feed a girl as a boy although she eats a third less calories, because the calories she does eat must carry nearly as much building and regulatory material as his, and her normal food intake is less sustained by the demand of hunger and more through the appeal which the food makes to the eye." [15-p. 421].

On this basis it is readily seen that girls' dietaries were more often inadequate than boys'. This may be, at least, in part, explained by the fact that the diets in these schools are too largely composed of starches, fats, and sweets. Large quantities of a diet of this type must be eaten in order to get sufficient quantities of nutrients. Girls normally do not consume as much as boys

for they are smaller in size and are less active. A starch, fat, sweet type of diet often causes girls to cut down on their food consumption for fear of getting "too fat." Girls need foods that are relatively richer in building and regulatory material than boys for they eat less.

A study including only consumption at meal time would not be complete. For this reason a record of foods eaten between meals was also obtained. Many boys and girls in agricultural high schools of Mississippi are working for part or full board, that is, few have cash to spend on extra food. In the majority of these schools students are allowed to go to town only twice a week, usually once on school days. Therefore, eating between meals as shown in Tables 6, 7, 8, and 9 is very limited. Between meal eating was greatest in the school in which one of the students was allowed to sell candy, fruit, sandwiches, and the like. Very few boys and girls consumed foods between meals which had been brought from home. In the light of these facts, it seems more important than ever that such schools should provide adequate dietaries, for pupils have little else but what they eat in the dining hall.

Table 6—Average Total Daily Energy and Nutritive Value of Food Consumed by 15-16-17 Year Old Boys in Three Types of Agricultural High Schools of Mississippi.

Energy and Nutritive Value per Child per Day	A SCHOOL			B SCHOOL			C SCHOOL			Ave. per Day
	At		Between Meals	At		Between Meals	At		Between Meals	
	Meals	Total		Meals	Total		Meals	Total		
Energy (Cal.)	3224	193	3414	3516	183	3699	3797	.....	3797	3637
Pro. (Gms.)	97.2	6.1	100.3	94.4	3.8	98.2	113.3	.....	113.3	103.9
Ca. (Gms.)	1.578	.009	1.587	1.190	.017	1.207	.870	.....	.870	1.221
P. (Gms.)	2.159	.066	2.525	1.776	.049	1.825	1.423	.....	1.423	1.924
Fe. (Gms.)	.0138	.0009	.0147	.0230	.0005	.0235	.0246	.....	.0246	.0209

Table 7—Average Total Daily Energy and Nutritive Value of Food Consumed by 15-16-17 Year Old Girls in Three Types of Agricultural High Schools of Mississippi

Energy and Nutritive Value per Child per Day	A SCHOOL*			B SCHOOL			C SCHOOL			Ave. per Day
	At		Between	At		Between	At		Between	
	Meals	Meals		Meals	Meals		Meals	Meals		
Energy (Cal.)	2340	173	2513	2226	81	2307	2045	176	2221	2347
Pro. (Gms.)	59.5	4.5	64.0	57.8	2.0	59.8	71.6	4.3	75.9	66.6
Ca. (Gms.)	.799	.026	.825	.782	.049	.831	.513	.026	.539	.765
P. (Gms.)	1.105	.055	1.160	1.093	.054	1.147	.895	.061	.956	1.088
Fe. (Gms.)	.0105	.0008	.0113	.0140	.0008	.0148	.0143	.0005	.0148	.0136

*Three day instead of four day averages.

Table 8—Average Total Daily Energy and Nutritive Value of Food Consumed by 18-19 Year Old Boys in Three Types of Agricultural High Schools of Mississippi.

Energy and Nutritive Value per Child per Day	A SCHOOL*			B SCHOOL*			C SCHOOL			Ave. per Day
	At		Total	At		Total	At		Total	
	Meals	Between Meals		Meals	Between Meals		Meals	Between Meals		
Energy (Cal.)	4235	123	4358	3493	66	3559	3790	273	4063	3993
Pro. (Gms.)	116.3	1.1	117.4	91.3	1.4	92.7	85.8	6.5	92.3	101.8
Ca. (Gms.)	2.106	.003	2.109	1.135	.....	1.135	.589	.049	.638	1.294
P. (Gms.)	2.355	.017	2.372	1.567	.....	1.567	1.261	.090	1.351	1.763
Fe. (Gms.)	.0212	.0001	.0213	.0192	.....	.0192	.0158	.0007	.0165	.0190

*Three day instead of four day averages.

Table 9—Average Total Daily Energy and Nutritive Value of Food Consumed by 18-19 Year Old Girls in Three Types of Agricultural High Schools of Mississippi.

Energy and Nutritive Value per Child per Day	A SCHOOL			B SCHOOL*			C SCHOOL			Ave. per Day
	Between		Total	Between		Total	Between		Total	
	At Meals	At Meals		At Meals	At Meals		At Meals	At Meals		
Energy (Cal.)	2072	153	2225	2178	85	2263	2533	192	2725	2404
Pro. (Gms.)	58.0	3.5	61.5	57.2	1.7	58.9	63.0	5.4	68.4	62.9
Ca. (Gms.)	.829	.022	.842	.673	.015	.688	.415	.008	.423	.651
P. (Gms.)	1.247	.052	1.299	1.024	.016	1.040	.891	.037	.928	1.089
Fe. (Gms.)	.0096	.0004	.0096	.0119	.0001	.0120	.0121	.0006	.0127	.0014

*Three day instead of four day averages

Food Consumption on School Days and Picnic Days Compared:

Table 10—A Comparison of the Average Total Daily Energy and Nutritive Value of Food Consumed by Students of Two Schools During Three Typical School Days with That Consumed by the Same Students on a Picnic Day.

Groups Studied	ENERGY AND NUTRITIVE VALUE PER PERSON PER DAY									
	ENERGY		PROTEIN		CALCIUM		PHOSPHORUS		IRON	
	Typical Day	Picnic Day	Typical Day	Picnic Day	Typical Day	Picnic Day	Typical Day	Picnic Day	Typical Day	Picnic Day
	cal.	cal.	gms.	gms.	gms.	gms.	gms.	gms.	gms.	gms.
15-16-17 year old girls (A School)	2513	3335	64.0	87.4	.825	1.233	1.160	1.324	.0113	.0073
18-19 year old girls (B School)	2263	2147	58.9	49.2	.688	.458	1.040	.805	.0120	.0110
18-19 year old boys (A School)	4358	3927	117.4	107.5	2.109	1.711	2.372	1.765	.0213	.0109
18-19 year old boys (B School)	3559	3072	92.7	103.0	1.135	1.402	1.567	1.803	.0192	.0160

In the A School (Table 10) the boys and girls had their picnic together. The following menu was served: Tomato and lettuce sandwiches, iced tea, ice cream cones, and marshmallows. In the other school, boys and girls had separate picnics. The boys had bacon, cheese, marshmallows, and rolls; the girls, peanut butter sandwiches, sour pickle, apples, stick candy, marshmallows, and sugar wafers.

From the data in Table 10 it seems that energy consumption is for the most part slightly lower on a picnic day. However, much would depend on what was served and the quantity available. These picnics were given by student organizations, all materials being purchased by them from their limited funds. The number to attend these picnics was carefully estimated and the food portioned out per person. There was no waste of food; in fact, many would have taken more had it been available.

Calories:

Table 11—Average Daily Calorie Intake of 15-16-17 Year Old Boys and Girls and of 18-19 Year Old Boys and Girls Included in the Study.

Sex	15-16-17 YEARS OF AGE			18-19 YEARS OF AGE		
	Av. Wt. in Kilo.	Av. Cal. per Kilo.	Av. Tot. Cal.	Av. Wt. in Kilo.	Av. Cal. per Kilo.	Av. Tot. Cal.
Boys	61.92	58.74	3637	71.36	55.96	3993
Girls	54.92	42.73	2347	57.38	41.90	2404

Table 11 gives the average daily calorie intake for boys and girls in the study. Rose [16-p.19] allows 65-50 calories per kilogram for boys from 14-17 years of age, 60-40 calories for girls from 14-17 years of age, and 55-40 calories per kilogram [15-p.99] for boys and girls from 18-25 years of age. The daily calorie intake of all four groups came within these allowances.

Energy requirements of boys and girls depend very largely on their activities. Therefore, perhaps a better way to get at their requirements would be to consider each boy and girl as an adult and figure their energy requirement on their activity records. Activity records, however, were obtained but for one day. It seems justifiable, nevertheless, to estimate boys' and girls' requirements on this one day's record since they lived on regular schedule and their activities varied little from one school day to the next. A detailed analysis is, therefore, made in Tables 12 and 13 of activities during this one day and energy required for these various activities.

Findings of this study apply to school days only. Activities and consumption over the week-end are probably quite different. A study of food consumption over the week-end was not deemed necessary as so many students spend their week-ends at home. Nor would Monday be a typical school day as Sunday's food intake may influence that of Monday's.

Table 12—Average Total Daily Energy Requirement of 15-16-17 Year Old Boys and Girls Based on Activities During One Typical School Day.

Activity	Cal. per Kilo. per Hr.		No. Hr.		Wt. Kilo.		Total Cal. per Period	
	boys	girls	boys	girls	boys	girls	boys	girls
Sleeping	.93	.93	8.6	8.5	61.92	54.92	495.2	434.1
Sitting quietly	1.43	1.43	6.8	7.4	"	"	602.1	581.2
Severe exercise	2.643	6.43	2.0	.8	"	"	796.3	282.5
Active exercise	4.14	4.14	1.5	.8	"	"	384.7	181.9
Light exercise	2.43	2.43	3.3	4.4	"	"	496.5	587.2
Dressing and undressing	1.69	1.69	1.0	1.3	"	"	104.8	120.7
Eating	1.43	1.43	.8	.8	"	"	70.8	62.8
Total calories per kilogram per day	(Boys 47.65 Girls 40.98)				Total calories (Boys 2950.0 Girls 2250.4)			

Table 13—Average Total Daily Energy Requirement of 18-19 Year Old Boys and Girls Based on Activities During One Typical School Day.

Activity	Cal. per Kilo. per Hr.		No. Hr.		Wt. Kilo.		Total Cal. per Period	
	boys	girls	boys	girls	boys	girls	boys	girls
Sleeping	.93	.93	8.5	8.3	71.36	57.39	564.1	443.0
Sitting quietly	1.43	1.43	6.5	8.1	"	"	663.7	664.7
Severe exercise	2.643	6.43	1.0	.5	"	"	458.8	184.5
Active exercise	4.14	4.14	1.5	1.0	"	"	443.7	237.6
Light exercise	2.43	2.43	4.7	4.3	"	"	815.0	599.7
Dressing and undressing	1.69	1.69	1.0	1.0	"	"	120.8	97.0
Eating	1.43	1.43	.8	.8	"	"	81.6	65.7
Total calories per kilogram per day	(Boys 44.10 Girls 40.94)				Total calories (Boys 3146.5 Girls 2292.2)			

Energy requirements of children depend not only on basal metabolism and activity but also on growth. The 15-16-17 year old girls, the 18-19 year old girls, and the 18-19 year old boys

in this study had already reached their maximum growth. The 15-16-17 year old boys were at the period of their greatest need. Therefore, extra allowances must be made for growth of this latter group.

Ten to 15 per cent of the basal metabolism will probably represent the growth requirement of the first three groups [15 p. 97]. Figuring thus, it seems that the 18-19 year old boys were the only group who were getting more than minimum energy requirement. As previously stated, physical examinations were not made. However, in the judgment of the investigator and the school matron, students in this study were all in fairly good, a few in excellent, physical condition.

Table 14 shows the weights of the 35 boys and 40 girls at the time of the study as compared with the Wood and Metropolitan Standards for height and age. Weight should give at least some indication of the present status of nutrition of these subjects.

Table 14—Weights of Agricultural High School Boys and Girls Compared with Wood and Metropolitan Standards.

Deviation from Standard	Boys				Girls			
	15-16-17 Years		18-19 Years		15-16-17 Years		18-19 Years	
	number	per cent	number	per cent	number	per cent	number	per cent
6.5% Above Standard	6	33	4	24	8	34	8	50
6% - 10% Above Standard ..	0	0	3	17	2	8	2	12
11% - 20% Above Standard ..	2	11	4	24	5	21	3	19
Total Above Standard	8	44	11	65	15	63	13	81
0.7% Below Standard	8	44	5	29	5	21	2	12
7% Below Standard	2	11	0	0	2	8	0	0
8% Below Standard	0	0	1	6	0	0	1	7
9% Below Standard	0	0	0	0	2	8	0	0
Total Below Standard	10	56	6	35	9	37	3	19

It is observed that 44 per cent of the 15-16-17 year old boys, 65 per cent of the 18-19 year old boys, 63 per cent of the 15-16-17 year old girls, and 81 per cent of the 18-19 year old girls are above average weight for height and age. That is, the majority of boys and girls studied are above the standard in weight for height and age. While no hard and fast conclusion can be drawn from this fact, it appears evident that the diets of these students are at least sufficient for the majority to obtain and maintain the average weight for their height and age. The girls in this study were about the height of the average American girl, the 17-18 year old boys about the height of the average American boy. The 15 and 16 year old boys were about one inch taller, the 19 year old boys about three inches taller than the average American boy of that age.

As previously stated, food was put on the tables in serving dishes and students allowed free choice. At the end of a meal, some food was generally left on the serving dishes at the girls' table but seldom (except unpopular dishes) at the boys' table.

This seemed to indicate that the girls were eating all they wanted but that the boys would have eaten more had it been available. Plate scraps were practically nil; for students in agricultural high schools are taught the sin of waste.

Protein:

Table 15—Average Daily Protein Intake of 15-16-17 Year Old Boys and Girls and of 18-19 Year Old Boys and Girls Included in Study.

Sex	15-16-17 YEARS OF AGE						18-19 YEARS OF AGE					
	Wt. in Kilo.	Gm. per Kilo.	Total Gms.	% An. Pro.	% Veg. Pro.		Wt. in Kilo.	Gm. per Kilo.	Total Gms.	% An. Pro.	% Veg. Pro.	
Boys	61.92	1.68	103.9	61	39		71.36	1.42	101.8	50	50	
Girls	54.92	1.21	66.6	55	45		57.38	1.10	62.9	54	46	

Mrs. Rose says, "For the growing child, the protein requirement varies with the rate of growth, being highest in infancy and gradually falling. It is most easily met by allowing from 10 to 15 per cent of the total calories in the form of protein. In the infant this will mean from 2½ to 3 grams of protein per kilogram of body weight per day, and for the older child always more than the adult requirement." [16-p. 25]. Protein furnished 11 per cent of the total day's calories in these diets. The younger boys and girls, as shown in Table 15, had a higher protein intake per kilogram than the older boys and girls. Boys consumed more total protein and protein per kilogram than did girls.

The source of protein in the diet is also given in Table 15. All four groups received one-half or more of their protein from animal sources, the percentage from these sources varying from 50 to 61 per cent with an average of 55 per cent. In only one school, that is, the C School in which food consumption of 18-19 year old boys and girls was studied, did less than half of the protein come from animal sources. This school used very few animal protein foods such as milk, meat, fish, eggs, or cheese.

Fat and Carbohydrate:

Data concerning the average fat and carbohydrate intake of each of the groups studied are found in Table 16.

Boys of the ages studied had a higher total fat and carbohydrate intake than girls of corresponding age did, and also a higher intake per kilogram. 18-19 year old boys had a higher total fat and carbohydrate intake than 15-16-17 year old boys but their fat and carbohydrate intake per kilogram was less than 15-16-17 year old boys. 15-16-17 year old girls consumed more total fat and fat per kilogram than 18-19 year old girls. On the other hand, 18-19 year old girls consumed more total carbohydrate and carbohydrate per kilogram than 15-16-17 year old girls.

Table 16—Daily Fat and Carbohydrate intake of 15-16-17 Year Old Boys and Girls and 18-19 Year Old Boys and Girls Included in The Study.

Sex	15-16-17 YEARS OF AGE					18-19 YEARS OF AGE				
	Tot. Fat Gms.	Fat per Kg. Gms.	Tot. CHO Gms.	CHO per Kg. Gms.		Tot. Fat Gms.	Fat per Kg. Gms.	Tot. CHO Gms.	CHO per Kg. Gms.	
Boys	150	2.39	473	7.49		170	2.23	502	6.71	
Girls	111	1.93	286	5.08		101	1.74	316	5.47	

Percentage Distribution of Calories:

Percentage distribution of calories between protein, fat, and carbohydrate for boys and girls in the two age groups studied, is given in Table 17. Mrs. Rose says, "Ordinarily about 50 per cent of the calories of the diet should be derived from carbohydrates with starch predominating and about 35 to 38 per cent from fat, protein furnishing the remainder." [16-p. 26]. These dietaries were 50 per cent carbohydrate, 39 per cent fat, and 11 per cent protein.

Thirty-one per cent of the energy supply of these diets came from cereal grain foods. This is higher than the distribution suggested by Rose for high school boys and girls. [15-p. 423]. Fats and oils also exceed her suggested standard. They furnish 28 per cent of the energy supply of these diets. She suggests 18 per cent. What is true of cereal grain foods, fats, and oils is also true of sweets. Thirteen per cent of the energy supply came from sweets. This exceeds Rose's allowance by 3 per cent. The explanation for the high percentage of sweets used by these boys and girls lies in generous amounts of cane syrup consumed. This syrup was rich in iron and a fairly good source of calcium. However, its use should have been kept in bounds for a number of boys and girls consumed syrup and biscuit at the expense of some more needed, but not quite as palatable food.

Eight per cent of the energy supply of these diets came from meats, eggs, and cheese. This is around the distribution suggested by Rose. The 10 per cent furnished by milk, on the other hand, came much below Rose's standard which for boys with a total intake of 3000 calories was 24 per cent, for girls 25 per cent of the total energy supply. This low average for milk was partly due to the fact that most of the milk consumed was butter milk or skim milk. This in part explains the high fat content of these dietaries. That is, butter milk or skim milk was used for drinking in order that butter could be generously served. Country children, who make up the boarding students of these dormitories have a violent prejudice against butter substitutes. On the other hand, they like butter milk. A generous supply of milk was available in four of the six schools studied although more available in the two A Schools. Milk was often

left in pitchers and glasses especially on the girls' table of these schools signifying that it was a case of their not eating what was available rather than of its not being available. Milk was not provided in sufficient quantities in two of the schools, that is, the two C Schools. There was a marked difference in the per cent of calories furnished by milk in the three types of schools studied; an average of 15 per cent being furnished in A Schools, 10 per cent in B Schools, and 4 per cent in C Schools.

Nine per cent of the energy supply came from fruits and vegetables which is about one-half of the standard suggested by Rose for high school boys and girls. Boys and girls have not learned to appreciate the value of salads and vegetables in their diets. Such foods are, therefore, oftentimes returned untouched, and because of waste involved by such a situation, there is a distinct tendency to cut down on the use of these foods.

One per cent of the energy supply was composed of miscellaneous foods such as pickle, cocoa, gelatin, or foods not belonging to the six above groups. In two of the schools studied these foods were not used.

Milk, cereals, and cane syrup furnished a slightly higher proportion of calories in the boys' diets than in the girls' diets. Meat, fish, eggs, fruits, and vegetables furnished a slightly higher proportion of calories in the girls' diet than in the boys' diet.

Table 17—Percentage Distribution of Total Calories Taken by 15-16-17 Year Old Boys and Girls and 18-19 Year Old Boys and Girls Included in the Study.

Sex	15-16-17 YEARS OF AGE			18-19 YEARS OF AGE		
	Protein Per Cent	Fat Per Cent	CHO Per Cent	Protein Per Cent	Fat Per Cent	CHO Per Cent
Boys	11	37	52	10	39	51
Girls	11	41	47	10	38	52
Average for Study				11	39	50

Minerals:

The average daily amounts of calcium, phosphorus, and iron included in the diets of the 75 boys and girls studied are shown in Tables 6, 7, 8, and 9.

Phosphorus—An extensive study of the phosphorus requirement of children has been made by Sherman and Hawley [18]. In this study it was found that optimum storage of phosphorus in children of three to thirteen years of age was not obtained until intake reached from 1.16 to 1.46 grams of phosphorus per child per day. As a result of this investigation one gram of phosphorus per day is usually allowed for children up to the age of fourteen and at least .004 gram per 100 calories or the allowance of a full-grown adult thereafter.

Figured on this basis, the minimum daily phosphorus requirement of the 4 groups studied (Tables 6, 7, 8, 9) would be 1.60 grams for 15-16-17 year old boys, 1.03 grams for 15-16-17 year old girls, 1.73 grams for 18-19 year old boys, and 1.06 grams for 18-19 year old girls. All four groups reached this minimum requirement, although only one group namely the 15-16-17 year old boys exceeded it by more than .1 gram.

Milk provided 42.7 per cent of the phosphorus in these dietaries. Cereals were the next abundant source, meat and eggs the next.

Calcium—Mrs. Rose says, "For an adult man an allowance of .68 gram of calcium per day may be regarded as liberal, but a growing child should have a full gram per day. In calculating ordinary adult dietaries, an allowance of .023 gram per 100 calories may conveniently be made, but the child's gram a day should be allotted independent of calories." [16-p. 26]. The 15-16-17 year old group would undoubtedly be classed as children, the 18-19 year old group as adults. As shown in Tables 6 and 7, 15-16-17 year old boys obtained an average of 1.221 grams of calcium, 15-16-17 year old girls an average of .765 gram of calcium per day. This means a calcium shortage for this group of girls. Figuring the calcium needs for the 18-19 group on the basis of .023 gram of calcium per 100 calories, the requirement of the 18-19 year old boys would be .92 gram, of the 18-19 year old girls .55 gram. Comparing this with their actual consumption as recorded in Tables 8 and 9, it is seen that both groups were well provided with calcium. Milk provided 77.5 per cent of the calcium in these dietaries. Fruits and vegetables were the next abundant source, sweets the next. As previously mentioned, cane syrup, a fairly good source of calcium* was generously used in these dietaries.

Iron—Mrs. Rose says, "Studies of iron requirement in an ordinary mixed diet indicate the average man can maintain iron equilibrium with an allowance of .015 gram per day or .0005 gram per 100 calories under ordinary conditions of activity. Women need as much as men, regardless of their smaller size and growing children need at least as much per 100 calories as adults." [16-p. 27]. Figured on the basis of .0005 gram per 100 calories the iron requirement for these four groups is as follows: 15-16-17 year old boys, .0182 gram, 15-16-17 year old girls .0122 gram, 18-19 year old boys .0200 gram and 18-19 year old girls .0120 gram. The 18 and 19 year old boys and girls received less than the above standard. The high school girls in this study should undoubtedly be considered as women in which case their iron

*Calcium content of syrup used in this study averaged .09 per cent or a little less than half the calcium content of the samples of molasses analyzed by Sherman. [17-p. 591].

requirement would be at least .015 gram per day. Neither group of girls reaches the latter standard.

Fruits and vegetables were the richest source of iron in these dietaries in spite of the fact that only about half as much of these foods was used as should have been. Cereals ranked next and meat and eggs and sweets followed.

An average of 18 per cent of the iron was furnished by cane syrup. In the C School in which food consumption of 15-16-17 year old boys and girls was studied, 46 per cent of the iron came from sorghum cane syrup. This sorghum contained .0175 per cent iron, over twice the iron figure given by Sherman for molasses. [17-p. 591]. This syrup had the highest iron content of any which has ever been analyzed in the Home Economics Department of the Mississippi Experiment Station. Cane syrup in the other five schools furnished from 8 per cent to 16 per cent of the iron content of the dietaries.

Vitamins:

No data are available by which the vitamin content of a diet can be studied quantitatively. However, by checking foods consumed which contain vitamins, it is possible to form a rough estimate of the vitamin content of a dietary.

The vitamin doubtless most abundant, is vitamin A due to the fairly generous use of butter. However, in the C School feeding 18-19 year old boys and girls no milk or eggs were used except in cooking. No butter was used at all. Green vegetables were served only once. This, of course, means that this dietary was very deficient in vitamin A, since it contained very small quantities of the foods considered as a good source. These studies were all conducted when egg production was high and eggs consequently plentiful and cheap. They were served 3 times during the study in 4 schools, 2 times in 1 school, and not at all in the school mentioned above.

Since these dietaries as a whole consisted too largely of highly milled cereals, fats, and sweets, and too few fruits and vegetables, it is doubtful whether vitamin B was provided in sufficient quantities.

The vitamin least adequately supplied perhaps was vitamin C, due to the small quantities of fruits and vegetables used. During the 13 meals studied, 4 foods considered a good source of vitamin C and 4 an excellent source of vitamin C were used in A Schools, and 1 an excellent source in B Schools, and 3 a good source and 1 an excellent source in C Schools. Cole slaw and lettuce, practically the only excellent source of vitamin C served besides canned tomatoes during these studies, were consumed in very small quantities, especially by the boys.

General Food Facts:

Use of Beverages and Condiments—Coffee was served at breakfast in five of the six schools studied. In the sixth school 50 cents extra board per month was charged for coffee at breakfast. Only the teachers and 2 or 3 of the students took coffee in this school. No tea was served during any of the studies except at one of the picnics. If milk was not available for dinner or supper no beverage was served.

The use of pepper, spices, catsup, pickles, that is, highly seasoned foods was not great. Only three of the six schools studied used pickle and catsup. Such foods, if used discriminately, have the value of lending variety to the low cost dietary.

Types of Meals Served—Food combinations as well as nutritive value is of interest in a study of this nature. A typical day's menu served during the experimental period in each of the six schools studied is, therefore, given.

Table 18—A Typical Day's Menu Served During Experimental Period in Each of the Six Schools Studied.

MENUS FROM A SCHOOLS

Breakfast	Dinner	Supper
Cornflakes or Post Bran	Boiled Cabbage	Cold Sliced Pork
Scrambled Eggs	Baked Sweet Potatoes	Fried Eggs
Biscuit	Pork Dressing	Stewed Prunes
Toast	Vegetable Salad	B'scuit
Butter	Crackling Bread	Butter
Top Milk (for cereal)	Butter	Milk
Milk	Butter Milk	Butter Milk
Coffee		Sugar Cane Syrup
Sugar Cane Syrup (commercial)		(commercial)
Cornflakes	Tuna Fish Salad	Fried Eggs
Bacon	Candied Sweet Potatoes	Grits
Biscuit	Turnip Greens	Stewed Peaches
Butter	Tomatoes	Biscuit
Milk	Cornbread	Gravy
Coffee	Crackers	Butter
Sugar Cane Syrup		Milk
		Sugar Cane Syrup

MENUS FROM B SCHOOLS

Breakfast	Dinner	Supper
Cornflakes or Oatmeal or Post Bran	String Beans	Bacon
Biscuit		
Butter	Creamed Irish Potatoes	Dried Peaches
Gravy	Fried Sweet Potatoes	Biscuit
Milk	Cornbread	Butter
Coffee	Chocolate Pie	Milk
Sugar Cane Syrup	Pickle	Gravy
		Sugar Cane Syrup
Cornflakes or Oatmeal with raisins	Macaroni and Cheese	Sausage (cured)
Muffins	Baked Sweet Potatoes	Grits
Butter	Rutabagas	Biscuit
Milk	Cornbread	Butter
Sugar Cane Syrup	Mince Pie	Buttermilk
	Catsup	Sugar Cane Syrup

MENUS FROM C SCHOOLS

Breakfast	Dinner	Supper
Salmon Croquettes	Salmon Croquettes	Canned Salmon (garnish- ed with boiled eggs)
Rice	Pork and Beans	
Biscuit	Turnip Greens	Rice
Butter	Cornbread	Hominy
Cocoa	Biscuit	Pork and Beans
Coffee	Bread Pudding	Biscuit
Sorghum Syrup		Cornbread
		Sorghum Syrup
Bacon	Fresh Pork Ham	Bacon
Fried Irish Potatoes	Mashed Irish Potatoes	Fried Irish Potatoes
Biscuit	Dried Field Peas	Rice
Gravy	Cornbread	Stewed Apples
Coffee	Gravy	Biscuit
Sorghum Syrup	Sorghum Syrup	Gravy
		Sorghum Syrup

As shown in Table 18, general type of menus served in these schools did not vary greatly. Breakfast usually consisted of a prepared cereal or potatoes*, a main dish (bacon, eggs, or salmon), biscuit, butter, cane syrup, milk, coffee, sugar. Prepared cereal was served more often than cooked cereal as it was preferred by the students.

*Sweet or Irish

Table 19—Percentage Distribution of Calories Furnished by Breakfast, Dinner, and Supper in Dieteries of 15-16-17 and 18-19 Year Old Boys and Girls.

Group	Percent of Total Calories Furnished at:			
	Breakfast	Dinner	Supper	Total
	percent	percent	percent	percent
15-16-17 year boys	35	28	37	100
15-16-17 year girls	31	35	34	100
18-19 year boys	30	27	43	100
18-19 year girls	29	38	33	100
Average	31	32	37	100

The boys ate a more hearty breakfast than did the girls. Table 19 shows that breakfast furnished from 29 percent to 35 percent of the total day's calories with an average of 31 percent.

Dinner usually consisted of potatoes, at least one other vegetable, bread, and either a dessert or a meat. Girls ate more at dinner than at any other meal, whereas, boys ate more at supper. Since dinner is the vegetable meal, this perhaps explains why girls' dietaries showed a higher proportion of calories from vegetables than boys' showed.

Supper usually consisted of a main dish (meat or substitute) a cereal, stewed fruit, milk, syrup, butter, and biscuit. It was the main meal for the boys and only second to dinner for girls. Table 19 shows that supper was the heaviest meal of the day and the other two meals were almost equal in calorie value, furnishing about 30 per cent of the day's food. This is not surprising for after an afternoon of one and a half or two hours of active sport and of one to two hours of work, one would expect a high consumption at supper time. It would seem that supper is the meal in which to introduce the much needed extra green vegetable or salad, for the boys and girls are hungry and would probably take it more readily at this meal.

The intake of the boys and girls did not vary greatly in amounts eaten from day to day, usual variation for boys during the four day period being about 700 calories, for girls about 350 calories. In one case variation among boys was 1239 calories. This occurred in a school in which menus were not carefully planned, that is, a preponderance of high calorie foods was used one day, a preponderance of low calorie foods the next.

That there was no greater variation from day to day is probably due to two facts: (1) the figures obtained in this study are averages for groups not individuals (2) activities of students from one school day to next did not vary greatly.

Monotony of food served was one of the most general complaints of food service in these schools. This was true in A Schools, although not to as great an extent as in B and C Schools.

In one of the schools, the school farm brought two hogs each week to the kitchen to be used. In another school, grits were served every night for supper. In another, salmon was bought in large quantities by the superintendent and it had to be served often to dispose of it. During the 13 meals of the study salmon was served at 6 meals. In another school, bacon and fried Irish potatoes were served every breakfast and supper and dried beans at every dinner during the study. The investigator was told that they were served every school day of the year. The superintendent did all the buying in this school.

It is as much a problem to avoid monotony when the school farm dumps large quantities of two or three foods into the kitchen each week as it is to use up the cases of salmon or pork and beans that the superintendent has bought.

In one of the A Schools, the school which served the greatest variety of foods during the study, the matron had full charge of the buying as well as the bookkeeping. She, however, felt that she could do much better if she had full cooperation from the agriculturalist. She said, "We have milk, eggs, pork, potatoes, and turnips from the farm but such vegetables as lettuce, radish, and onions are unheard of."

The food was well prepared in four of the six schools in which food consumption was studied. These four schools employed experienced cooks. The other two schools used student labor. In these two schools, three students spent over four hours a day in the kitchen. Method of preparation is even more important in getting foods eaten than is variety of foods served. For this reason, good cooks are necessary and especially in institutions using as low cost foods as these.

In some of these schools menus were limited because of poor equipment. In one school the cook had to come to the kitchen at 4:30 A. M. to get the stove hot enough to cook breakfast. In another, there was no kitchen sink. In another, there were not enough glasses or china to go around. Dishwashing facilities were unusually poor in three of the schools. Only two of the schools had good institutional cooking utensils. Indeed, the use made of the available food supply was good if one takes into consideration facilities available for preparation of the same.

In all but one of these schools, students were required to come to meals on time and to stay in the dining room until all had finished. An average of about 17 minutes per meal or 50 minutes a day was spent in the dining hall.

Money Value of Food:

Table 20—Average Money Value of Food Actually Consumed per Student per Day in Six Agricultural High Schools of Mississippi.

Age Group	Average Money Value of Food Consumed per Student per Day:							
	A SCHOOLS		B SCHOOLS		C SCHOOLS		AVERAGE	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
	dollars	dollars	dollars	dollars	dollars	dollars	dollars	dollars
15-16-17 years	.35	.22	.28	.19	.29	.18	.31	.20
18-19 years	.35	.26	.28	.20	.26	.20	.30	.22

As previously mentioned, cost of food purchased was obtained from the matron or bookkeeper. Food raised on the school farm was valued at average wholesale prices. Calculated in such a way value of food actually consumed as shown in Table 20 by 15-16-17 year old boys amounted to 31 cents per boy per day, by 15-16-17 year old girls to 20 cents per girl per day, by 18-19 year old boys to 30 cents per boy per day, and by 18-19 year old girls to 22 cents per girl per day. This means an average value of 31 cents a day for boys, 21 cents a day for girls. Cost of condiments, beverages, or items having no food value was disregarded.

On the above basis, it cost one-third less to feed a girl than a boy. The superintendent in one of the schools in which these studies were conducted foresaw these very results. He said, "Wouldn't a cafeteria service be fairer than letting the girls pay for part of the boys' food?" It is doubtful whether a cafeteria service would work in a school catering to boys and girls of high school age on such limited funds as these have. Many would do on too little or make unwise choices unless they were very closely supervised.

The remedy for this situation it seems is to educate the girls in these schools to the necessity of eating the foods which carry large quantities of building and regulating material. It is more a problem of food values than of money values.

Williams and Lockwood [21] as well as others have shown that there is an adequate low cost food limit. What this limit is for agricultural high school dormitories of Mississippi is, however, unknown. The season, the market, and the farm are some of the factors which would enter into such a calculation.

Board charged in these schools ranged from \$9.00 to \$13.00 per month with an average for A Schools of \$12.50, B Schools of \$10.00, and C Schools of \$11.00. The diet was somewhat more adequate in schools charging the most board, that is, A Schools. Board generally included light, water, heat, and labor as well as food. Of the total money value 27 per cent was for breakfast, 36 per cent for dinner, and 37 per cent for supper. A

greater proportion is usually allowed for dinner but considering afternoon activities of these boys and girls it seems that a greater proportion is needed for supper. Expenditures between meals were not excessive, averaging only about 4 cents per student per day.

Relation of Money Value to Energy and Nutritive Value:

Table 21—Relation of Money Value to Energy and Nutritive Value in Dieteries of 15-16-17 Year Old Boys per Day.

Day	Energy	Protein	Calcium	Phosphorus	Iron
cents	calories	grams	grams	grams	grams
28	3516	94.4	1.190	1.776	.0230
29	3797	113.3	.870	1.423	.0246
35	3224	97.2	1.578	2.459	.0138
of 18-19 Year Old Boys per Day					
26	3790	85.8	.589	1.261	.0158
28	3493	91.3	1.135	1.567	.0192
35	4235	116.3	2.106	2.355	.0212
of 15-16-17 Year Old Girls per Day					
18	2045	71.6	.513	.895	.0143
19	2226	57.8	.782	1.093	.0140
22	2340	59.5	.799	1.105	.0105
of 18-19 Year Old Girls per Day					
20	2533	63.0	.415	.891	.0121
20	2178	57.2	.673	1.024	.0119
26	2072	58.0	.820	1.247	.0096

Table 21 brings out the relation of money value to energy and nutritive value in dieteries of the four groups studied. Dieteries of higher money value were superior in calcium and phosphorus to dieteries of lower money value. It seems probable that in a few instances money value was too low to obtain an adequate diet. It is of vital importance that schools which must keep their board to the minimum, as must these, raise a variety of foods on their farms letting boarding departments have the same at cost.

Food Purchased and Food Furnished:

Does it pay from a nutritive standpoint to raise food on the school farm? Fifty-four per cent of the value of the food consumed in A Schools came from the school farm, 47 per cent in B Schools, and 37 per cent in C Schools. As will be remembered from previous discussions, the animal protein, calcium, phosphorus, and vitamin intake were higher in A Schools.

Food raised on the school farm probably accounts for, at least, a part of the difference found in food consumption of the groups studied. This is especially true of milk, for if the farm did not provide milk in sufficient quantities, milk was not bought and the calcium consumption was consequently low.

Table 22—Per Cent of Different Food Classes Purchased and Per Cent Furnished by the Farm.

Food	Purchased	Furnished
	per cent	per cent
Meat and Fish	39	61
Fruits	89	11
Vegetables	85	15
Milk and Products	1	99
Poultry and Products	33	67

The figures in Table 22 seem to indicate that the agricultural high school is more likely to spend its money for vegetables and fruits than for milk, eggs, and meat.

In the bulletin, "Food for Farm Families," [1] the proportion of the farm diet grown at home was estimated as follows: Meat, 75 per cent; fruit, 60 per cent; vegetables, 80 per cent; milk and products, 85 per cent; poultry and products, 100 per cent. These agricultural high schools have much to do, as far as food raised on the farm is concerned, before their record comes up to this estimate.

SUMMARY

The actual food eaten by eighteen 15-16-17 year old boys, twenty-four 15-16-17 year old girls, seventeen 18-19 year old boys, and sixteen 18-19 year old girls in schools of three adequacy types was weighed for a period of thirteen consecutive meals. Information concerning foods and amounts eaten between meals was also obtained. These food consumption data were supplemented with information in regard to height, weight, and activity of these boys and girls. Facts collected in this manner have been classified and results tabulated. A summary of results follows:

1. The average total daily energy and nutritive value of food consumed by 15-16-17 and 18-19 year old boys and girls in six agricultural high schools of three adequacy types each is as follows:

Table 23—Average Total Daily Energy and Nutritive Value of Food Consumed by 15-16-17 and 18-19 Year Old Boys and Girls in Six Agricultural High Schools of Mississippi.

Group	Average Energy and Nutritive Value per Child per Day				
	Energy	Protein	Calcium	Phosphorus	Iron
	calories	grams	grams	grams	grams
15-16-17 year old boys	3637	103.9	1.221	1.924	.0209
15-16-17 year old girls	2347	66.6	.765	1.088	.0136
18-19 year old boys	3993	101.8	1.294	1.763	.0190
18-19 year old girls	2404	62.9	.651	1.089	.0114

2. Very little food was eaten between meals, the most being in a school where a student was allowed to sell food to dormitory students.

3. The calcium, phosphorus, animal protein, and vitamin content of diets of boys and girls in schools from which the best menus were obtained before the study began (on which basis the schools were selected) was more adequate than these same factors in diets of boys and girls in schools from which the poorest menus were obtained.

4. Energy consumption in the two schools in which there were picnics was slightly lower on the picnic day for three of the groups.

5. The average daily intake per kilogram for 15-16-17 year old boys was 58.74 calories, for 15-16-17 year old girls 42.73 calories, for 18-19 year old boys 55.96 calories, and for 18-19 year old girls 41.90 calories. These findings came within Rose's allowance and within the energy requirement figured on one day's activity record. Since the majority of boys and girls studied were above standard in weight for height and age, it would seem that the food consumed was sufficient, at least, for the majority.

6. The average daily protein intake per kilogram for 15-16-17 year old boys was 1.68 grams, for 15-16-17 year old girls, 1.21 grams, for 18-19 year old boys 1.42 grams, and for 18-19 year old girls 1.10 grams. This comes within Rose's allowance. An average of fifty-five per cent of the protein came from animal sources.

7. The average daily fat and carbohydrate intake per kilogram for 15-16-17 year old boys was 2.39 grams and 7.49 grams respectively, for 15-16-17 year old girls 1.93 grams and 5.08 grams respectively, for 18-19 year old boys 2.33 grams and 6.71 grams respectively, and 18-19 year old girls 1.74 grams and 5.47 grams respectively.

8. Thirty-one per cent of the energy supply of these diets came from cereals, 28 per cent from fats, 13 per cent from sweets, 8 per cent from meats, eggs, and cheese, 10 per cent from milk, and 9 per cent from fruits and vegetables. Cereals, fats, and sweets exceeded Rose's allowance; milk, fruits, and vegetables failed to meet her allowance; meat, eggs, and cheese furnished her allowance. Milk, cereals, and cane syrup furnished a slightly higher proportion of calories in the boys' diets; meat, fish, eggs, fruits, and vegetables in the girls' diets.

9. All four groups met the minimum daily phosphorus requirement of .044 gram per 100 calories. Treating the 15-16-17 year old group as children with a standard of a gram of calcium per day and the 18-19 year old group as adults with a standard of .023 gram of calcium per 100 calories per day, the 15-16-17 year old girls are the only group who failed to get sufficient

quantities of calcium. The 18-19 year old boys and girls fail to meet a daily iron requirement of .0005 gram per 100 calories. Neither group of girls gets a sufficient quantity of iron if they are considered as women with a daily requirement of .015 gram.

10. From a study of foods used the vitamin doubtless most abundant was vitamin A, least abundant vitamin C.

11. Spices, beverages, and highly seasoned foods were used with discretion.

12. Thirty-one per cent of the calories were furnished by breakfast, 32 per cent by dinner, and 37 per cent by supper. Boys ate more at supper, girls at dinner.

13. Intake from day to day did not vary greatly.

14. Monotony of foods served was a general complaint. This was in part due to the fact that the variety of foods raised on the school farm was not as great as it should have been.

15. Foods were more palatably prepared in schools hiring experienced cooks.

16. Equipment and facilities for preparing and serving food were often not adequate.

17. The average daily money value of food actually consumed was for 15-16-17 year old boys—31 cents, for 15-16-17 year old girls—20 cents, for 18-19 year old boys—30 cents, and 18-19 year old girls—22 cents. Twenty-seven per cent of this was for breakfast, 36 per cent for dinner, and 37 per cent for supper.

18. Dietaries in which money value of foods actually consumed was greatest were in schools charging higher board.

19. Dietaries in which money value was highest were superior in calcium, phosphorus, animal protein, and vitamins.

20. Dietaries were more adequate in schools where greatest proportion of food consumed was raised on the school farm.

APPENDIX

Table A—Age, Height, and Weight of Children from A Schools

Sex	Age years	Height inches	Weight		Standard Weight lbs.	Above or Below (-) Standard Weight lbs.	Difference in Percentage per cent
			lbs.	kilo.			
M	15	69.37	159.12	72.32	140	19.12	13.7
M	16	70.62	155.87	70.85	150	5.87	3.9
M	16	71.00	147.75	67.15	150	-2.25	-1.5
M	16	69.00	130.12	59.14	141	-10.88	-7.7
M	17	69.87	144.12	65.50	146	-1.88	-1.8
M	17	68.00	130.87	59.48	138	-7.13	-5.2
F	15	60.50	100.25	45.56	106	-5.75	-5.4
F	16	66.00	140.12	63.69	126	14.12	11.2
F	16	68.25	135.87	61.76	132	3.87	2.9
F	17	62.00	119.12	54.14	114	5.12	4.5
F	17	63.50	140.00	63.63	121	19.00	15.7
F	17	68.00	153.00	69.55	133	20.00	15.0
F	17	61.25	125.12	56.87	109	16.12	14.8
M	18	68.00	135.37	61.53	139	-3.63	-2.6
M	18	67.25	143.00	65.00	135	8.00	5.9
M	18	69.50	165.00	75.00	147	18.00	12.2
M	19	73.50	174.12	79.14	168	6.12	3.6
M	19	71.00	165.00	75.00	153	12.00	7.8
F	18	63.37	136.12	61.87	119	17.12	14.4
F	18	64.87	130.25	59.20	125	5.25	4.2
F	19	65.50	124.12	56.41	130	-5.88	-4.5

Table B—Age, Height, and Weight of Children from B Schools

Sex	Age	Height	Weight		Standard Weight	Above or Below Standard Weight	Difference in Percentage
			lbs.	kilo.		(-) Standard Weight	
	years	inches			lbs.	lbs.	per cent
M	15	62.37	104.00	47.27	109	-5.00	-4.6
M	15	66.37	132.25	60.11	127	5.25	4.1
M	15	65.50	134.00	60.90	128	6.00	4.7
M	16	68.50	130.25	59.20	141	-10.75	-7.6
M	16	65.50	121.87	55.39	128	-6.13	-4.8
M	16	66.37	134.00	60.95	128	6.00	4.7
M	17	66.37	126.75	57.61	129	-2.25	-1.7
F	15	66.37	115.00	52.27	124	-9.00	-7.3
F	16	64.50	110.87	50.39	123	-12.13	-9.9
F	16	65.00	125.00	56.81	123	2.00	1.6
F	16	63.00	116.12	52.73	117	-.88	-.7
F	16	59.87	92.00	41.81	102	-10.00	-9.8
F	16	61.12	116.25	52.84	108	-8.25	-7.6
F	17	61.87	111.12	50.50	114	-2.88	-2.5
F	17	63.00	117.00	53.18	118	-1.00	-.8
F	17	60.62	103.87	47.21	109	-5.13	-4.7
M	18	71.00	165.12	75.05	152	13.12	8.6
M	18	71.00	169.87	77.21	152	17.87	11.8
M	18	67.62	157.00	71.36	139	18.00	12.9
M	19	70.87	146.00	66.36	153	-7.00	-4.6
M	19	71.12	164.00	74.54	153	11.00	7.2
F	18	63.37	120.12	54.59	119	1.12	.9
F	18	64.37	132.00	60.00	122	10.00	8.2
F	18	64.00	123.12	55.96	122	1.12	.9
F	18	61.50	120.12	54.60	115	5.12	4.4
F	19	63.50	113.00	51.36	123	-10.00	-8.1
F	19	61.12	112.25	51.02	114	-1.75	-1.5

Table C—Age, Height, and Weight of Children from C Schools

Sex	Age	Height	Weight		Standard Weight	Above or Below Standard Weight	Difference in Percentage
			lbs.	kilo.		(-) Standard Weight	
	years	inches			lbs.	lbs.	per cent
M	16	64.62	119.12	54.14	124	-4.88	-3.9
M	17	64.87	138.25	62.84	125	13.25	10.6
M	17	70.50	154.00	70.00	151	3.00	2.0
M	17	65.62	125.87	57.21	129	-3.13	-2.4
M	17	73.37	164.12	74.59	161	3.12	1.9
F	15	64.12	125.87	57.21	119	6.87	5.8
F	15	61.12	110.00	50.00	106	4.00	3.8
F	16	64.87	132.50	60.22	123	9.50	7.7
F	16	63.75	126.50	57.50	120	6.50	5.4
F	17	61.37	110.00	50.00	109	1.00	.9
F	17	63.87	130.12	59.14	121	9.12	7.5
F	17	61.12	130.00	59.09	109	21.00	19.2
F	17	61.12	114.25	51.93	109	5.25	4.8
M	18	67.62	135.00	61.36	139	-4.00	-2.9
M	18	70.00	151.87	69.03	147	4.87	3.3
M	19	69.87	140.00	63.63	148	-8.00	-5.4
M	19	70.00	153.00	69.55	143	5.00	3.4
M	19	73.87	164.25	74.65	163	-3.75	-2.2
M	19	74.75	158.37	71.94	173	-14.63	-8.5
M	19	73.00	182.00	82.72	163	19.00	11.6
F	18	68.87	139.00	63.18	137	2.00	1.5
F	18	59.62	118.37	53.80	106	12.37	11.7
F	18	65.00	135.00	61.36	125	10.00	8.0
F	18	61.37	124.25	56.47	111	13.25	11.9
F	18	66.37	129.00	58.63	123	1.00	.8
F	19	63.25	125.87	57.21	120	5.87	4.9
F	19	66.87	137.75	62.61	134	3.75	2.8

ACTIVITIES

Name _____ School _____

Age _____ Date _____

What were you doing yesterday at the following times:

(If 2 or 3 activities are carried on in same hour, give approximate number of minutes devoted to each.)

From 3 A. M.-4 A. M. _____

4 A. M.-5 A. M. _____

5 A. M.-6 A. M. _____

6 A. M.-7 A. M. _____

7 A. M.-8 A. M. _____

8 A. M.-9 A. M. _____

9 A. M.-10 A. M. _____

10 A. M.-11 A. M. _____

11 A. M.-Noon _____

Noon-1 P. M. _____

1 P. M.-2 P. M. _____

2 P. M.-3 P. M. _____

3 P. M.-4 P. M. _____

4 P. M.-5 P. M. _____

5 P. M.-6 P. M. _____

6 P. M.-7 P. M. _____

7 P. M.-8 P. M. _____

8 P. M.-9 P. M. _____

9 P. M.-10 P. M. _____

10 P. M.-11 P. M. _____

11 P. M.-Midnight _____

Midnight-3 A. M. _____

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Agricultural High School Dormitories

Of

Mississippi

By

DOROTHY DICKINS



Dormitories in two of the agricultural high schools of Mississippi. The one above is modern in every respect, the one below is typical of the frame type which is still found in a number of schools.

Mississippi Agricultural Experiment Station

A. & M. College, Mississippi

W. R. Perkins, Director

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AGRICULTURAL HIGH SCHOOL DORMITORIES OF MISSISSIPPI

By

DOROTHY DICKINS

Purpose and Method of the Study

In 1908 an act was passed by the Mississippi legislature providing for the establishment and maintenance of county agricultural high schools. In order to qualify for state appropriations, these schools were required to own a minimum of twenty acres of land, to provide dormitory space to house at least forty persons, and to be approved by the state board of education through the recommendations of the state superintendent of education. No restrictions were placed on outside-of-state students entering these schools. In practically every case, however, tuition is charged, the fee ranging from \$10.00 a session to \$3.00 a month.

The majority of counties have taken advantage of this act, some alone and others in conjunction with an adjoining county or counties. There are, at present, 47 agricultural high schools in the state, 12 of which offer junior college work in addition to a 4 year high school course. Several thousand rural boys and girls reside in the dormitories of these schools. Despite this fact, very little definite information is available about these dormitories. This study for the purpose of acquainting the public with life in the agricultural school dormitory was, therefore, made by the Department of Home Economics of the Mississippi Experiment Station during the school session of 1929-30*.

Of the 47 schools, 37 were personally visited and information obtained through interviews with school officials and dormitory matrons. The home economics instructors in the other ten schools cooperated with the Experiment Station by furnishing the necessary data.

*Data from a few schools collected in the spring of 1929.

PERSONS LIVING IN THE DORMITORY

Table 1—Classification of Persons Living in 47 Agricultural High Schools of Mississippi During 1929-30.

School No.	Students living in dormitories			Others living in dormitories			Total persons living in dormitories
	Students with reg'l'r employ'm't	Other students	Total	Teachers	Matrons	Other persons	
	Number	Number	Number	Number	Number	Number	Number
18	3	21	24	4	1	0	29
25	0	27	27	6	1	0	34
41	4	27	31	8	1	0	40
34	14	21	35	4	1	0	41
44	12	22	34	9	1	0	44
6	15	24	39	4	1	2	46
7	10	28	38	8	1	0	47
26	8	30	38	8	1	0	47
1	12	28	40	7	1	0	48
4	9	28	37	8	1	2	48
23	16	23	39	8	1	0	48
29	18	19	37	10	1	0	48
46	33	3	36	11	1	0	48
33	15	25	42	6	1	2	49
47	11	29	40	8	1	0	49
40	5	38	43	8	1	0	52
30	30	10	40	11	1	3	55
8	15	31	46	10	1	2	59
10	8	43	49	7	1	0	59
2	10	40	50	8	1	0	60
43	5	49	54	6	1	0	61
24	23	32	55	6	1	0	62
3	20	40	60	4	1	1	66
19	10	48	58	6	1	1	66
13	22	38	60	6	1	1	68
17	19	41	60	14	1	0	75
12	10	55	65	9	1	1	76
36	18	47	65	10	1	2	78
38	25	45	70	8	1	0	79
5	15	60	75	6	1	0	82
35	17	55	72	10	1	0	83
28	20	50	70	12	2	1	85
42	35	43	78	7	1	0	86
45	20	60	80	10	1	0	91
27	25	55	80	15	1	6	102
32	25	55	80	15	1	6	102
21	25	65	90	13	1	0	104
11	25	71	96	8	1	6	111
39	12	90	102	10	1	0	113
22	25	80	105	11	1	0	117

Table 1—Classification of Persons Living in 47 Agricultural High Schools of Mississippi During 1929-30. (continued).

School No.	Students living in dormitories			Others living in dormitories			Tot'l pers'ns living in dormitories
	Students with reg'l'n employ'm't	Other students	Total	Teachers	Matrons	Other persons	
	Number	Number	Number	Number	Number	Number	Number
16	25	90	115	15	1	0	131
37	69	61	130	18	2	0	150
15	30	128	158	13	3	0	174
31	79	81	160	20	2	0	182
20	73	98	171	16	1	0	188
14	75	115	190	16	2	0	208
9	28	275	303	22	2	0	327
Total	1023	2444	3467	459	54	36	4018

Students:

The 3467 dormitory pupils (Table 1) made up about 40 per cent of the total enrollment in the agricultural high schools. They are from families living at a distance from the school, broken families, or families with personal reasons for preferring dormitory life for their boys and girls.

Practically all students live in the county in which the school is located or in an adjoining county. There are a few boarders, however, in every dormitory who are several hundred miles from home. At the time of the study, the following states were represented: Mississippi, Alabama, Tennessee, Louisiana, Florida, South Carolina, and Wisconsin. Out-of-state students are usually attracted to the school through some relative or friend. About 33 per cent of the dormitory pupils are given regular employment which pays part or all of their board. About 16 per cent earn part of their expenses by extra or seasonal employment.

Students ranged from 14 to 23 years* of age, the average age being about 13 years. The girls were, on the whole, younger than the boys.

Members of Faculty:

Faculty members of agricultural high schools are generally required to live in the school dormitory unless they happen to reside in the community in which the school is located. Four hundred and fifty-nine, or about 90 per cent of the entire faculty, were living in dormitories at the time this study was made.

Agricultural high school teachers, unlike teachers in town or consolidated schools, have their pupils ever with them. In 44 schools they must chaperone them to town, to church, or to any function off the campus. In 43 schools, they must supervise the study period. In 36 schools they

*One school housed several grammar school pupils. Six superintendents have supervision of the elementary school in the community where the agricultural high school is located.

must inspect bedrooms. They are responsible for order in the dining room. In 3 schools they are asked to help in caring for sick students.

In only 3 schools are teachers entirely free of duties other than teaching. In two of these the matron takes care of all these duties. In the other, a teacher is given her board to look after these duties. Teachers living in agricultural high school dormitories have, therefore, little time or opportunity for anything but school. Some find such a life extremely confining. Several school officials spoke of the difficulty of getting teachers who would meet the strenuous requirements of dormitory life.

Matrons:

There is one woman employed in each school to look after food service. She is generally known as the matron rather than the dietitian, for planning and serving balanced meals at a limited cost is only one of her many duties. In five schools, 2 matrons, and one school 3 matrons are employed. In these six schools the duties are divided, and one of the women is in charge of food service, the other serves as housekeeper and social adviser. Two of the matrons have had training in the care of the sick.

Duties of Matrons:

What are the duties of the 47 women employed primarily to plan and serve well-balanced meals at a limited cost? All must see to the eradication of pests. All must cooperate with other members of faculty. Forty-three must act as hostess for the school, as lady principal, and as telephone clerk. Thirty-nine must care for the sick. Thirty-eight must buy all the supplies. Thirty-seven must employ the working force. Seven must keep books. Six must inspect bed rooms. Three must keep study hall at night. Two must collect the board. Two must teach. One matron has wisely said, "Ours is a 24 hour a day job." The success or failure of a dormitory largely depends on the ability and personality of this 24 hour a day employee.

Training of Matrons:

Of the matrons 65 per cent have had no training in home economics, 26 per cent have taken a summer or correspondence course in home economics, and 9 per cent have had one year or more training in home economics. There is only one home economics graduate employed, who is in Copiah-Lincoln Agricultural High School and Junior College. Here the matron is really "School Dietitian" for her duties are limited to that of food service.

Menus planned by matrons with home economics training were on the whole more adequate than menus planned by matrons with no home economics training. Dr. Hawley says, "A college boarding house under the supervision of a person untrained in food values is rather likely to serve an inadequate diet. This is especially true when a person of that kind tries to save money on food bills." [3-p. 14]

Of the matrons in agricultural high schools 40 per cent are the wives of the superintendents of these schools. In some schools, the school board requires that the superintendent's wife take the matronship. Such an arrangement is working out excellently in a number of schools. Superintendents' wives are for the most part former teachers who are somewhat more likely to understand children than other women. The majority realize that a successful dormitory contributes to the school and in turn to the career of their husbands. When the Institutional Section of the

Mississippi Home Economics Association offered a correspondence course for matrons, twice as many superintendents' wives took this course as did other matrons. On the other hand, there are conditions under which the superintendent's wife should not serve as matron. In some instances she does not have the time to do the work because she has small children; in other instances, she is not personally qualified.

The matrons attending a conference at the Mississippi State College for Women in the summer of 1925 [6] agreed that the qualifications for a matron of an institutional home should be:

1. Woman of maturity, preferably a married woman who has borne children.
2. One who has the power of self-control and the ability to control others.
3. One who has a pride in the home, a due sense of proportion, and a love for cleanliness and order.
4. One who is able to cooperate with others and be on the alert for new ideas and good old ones.
5. One who has a sympathetic understanding of young boys and girls, and is a fairly good judge of character.

These qualifications, however, do not take into consideration scientific training. A woman who is to feed from 29 to 327 people daily should have a scientific as well as a personality background. The larger schools can get around this difficulty by employing a dietitian, a lady principal, and a housekeeper—but what of the majority, schools housing less than a hundred boarders?

Each of these schools has a person with that scientific training under its very roof, namely, the home economics instructor. She, for the most part, has not been used by the boarding department. Only three relations usually exist between the boarding department and the department of home economics. They are: The home economics instructor generally plans the meals and supervises food service when the matron is sick; the matron occasionally asks the home economics teacher for suggestions about foods to serve; the two departments cooperate at banquet time. In only a few schools does teaching of home economics occupy full time. This is in larger schools which can afford to employ a dietitian as well as a social adviser. In schools where teaching of home economics does not occupy full time, classes of mathematics, science, or history are given to the home economics instructors. It seems that this time could more profitably be spent as school dietitian. Surely a mature, well-trained home economics instructor could direct food service in the dormitory as well as keep up with a part time home economics teaching schedule.

In Marshall County Agricultural High School such a plan is used. Here every senior cookery student living in the dormitory serves a week as assistant dietitian. She plans the meals, issues the supplies, and is, in fact, responsible to the Home Economics Instructor for food service in the dormitory during that week. On the day in which this school was visited the following dinner was served: Ham, spaghetti and tomato, dried butter beans, cole slaw, biscuit, cornbread, butter, skim milk, and blackberry cobbler. This meal went off like clock-work, so systematized was the service.

Putting the food service into other hands would release the agricul-

tural school matron of one of her big jobs. This would give her more time for the young people in her institutional home, time to do some of the things previously demanded of teachers, time to train and develop her boys and girls—an opportunity which she needs and has expressed a desire for.

Experience of Matrons:

Of the matrons 44 per cent have had less than 4 years of experience in institutional work, 19 per cent from 4 to 7 years of experience, and 37 per cent over 7 years of experience. These matrons have had on the average 6 years of experience in institutional work.

Salary of Matrons:

Only 15 per cent of the matrons were getting over \$1000.00 a year. The average* salary paid was \$727.00 a year plus board. Board for an eleven months' period (the time usually spent per year in the dormitory) averaged about \$130.00. This means that the agricultural high school matron received a salary equivalent to \$857.00 a year. The average* salary for home economics teachers in these schools was \$1025.00 a year, that is, \$168.00 more than that received by the matrons. Practically all the home economics instructors, however, were college graduates.

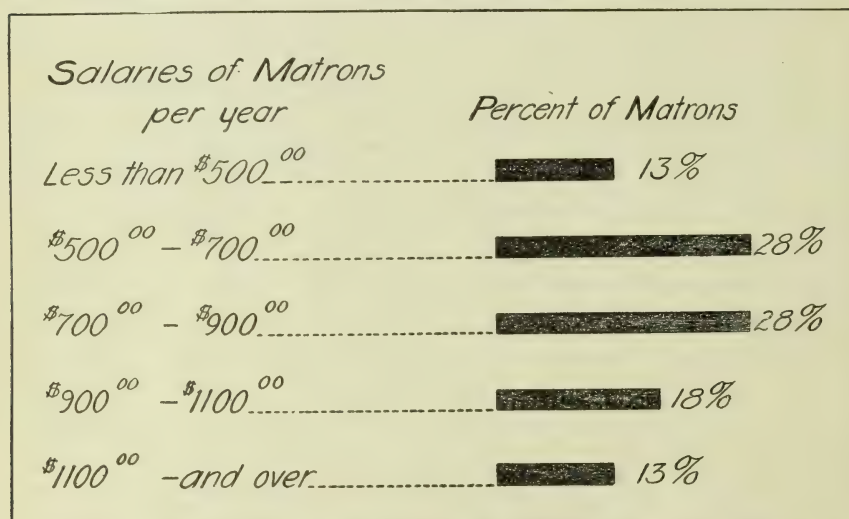


Fig. 1—Salaries of the 54 Matrons in Agricultural High Schools of Mississippi 1929-30.

The lowest salary was \$200.00 a year. This was paid to the wife of a school agriculturist for supervision of a boys' dormitory. The highest salary was \$1437.50 a year. This was paid in an agricultural high school with a junior college department. Only one matron was employed in this school.

Matrons without home economics training received an average salary of \$723.00 a year, whereas, those with training received \$830.00 a year. Since training in home economics is not, as a general rule, a requirement for such a position and since only 9 per cent of the matrons had as much as a year's training and only 35 per cent had any training at all, one would expect to find little relationship between salary and training.

*Median salary.

Experience seems to count more than training so far as salary is concerned. Matrons with 7 years or more institutional experience received about \$200.00 a year more salary than did matrons with less experience.

HOUSING CONDITIONS

Grounds:

Of the grounds 40 per cent were judged good in appearance, 47 per cent fair, and 13 per cent poor. The points considered in this judgment were freedom from trash, landscaping, and drainage. The grounds of all except 6 schools were free from trash at the time the school was visited. In some schools, dormitory pupils committing minor offenses are required to pick or rake up trash. In other schools, certain groups of students are assigned the project of beautifying the campus as a practical problem in the study of agriculture. In a few schools, students are employed to look after the campus.

Of the schools 51 per cent have landscaped grounds, 19 per cent have made a slight beginning, and 30 per cent have made no attempt. Poor selection of school sites as well as lack of funds has hindered this work. Some of the dormitories are set too near the road, some are on ridges, and some are in hollows. County officials should realize the value of beautiful school surroundings for all schools. Such a realization would call for more deliberation in selecting school sites and increased appropriations to remedy poor sites already selected. However, poor sites and lack of funds do not entirely account for the poor or fair appearance of 23 of the school grounds. In some instances, school grounds could be made more beautiful if the school people were interested enough to make the effort to beautify them.

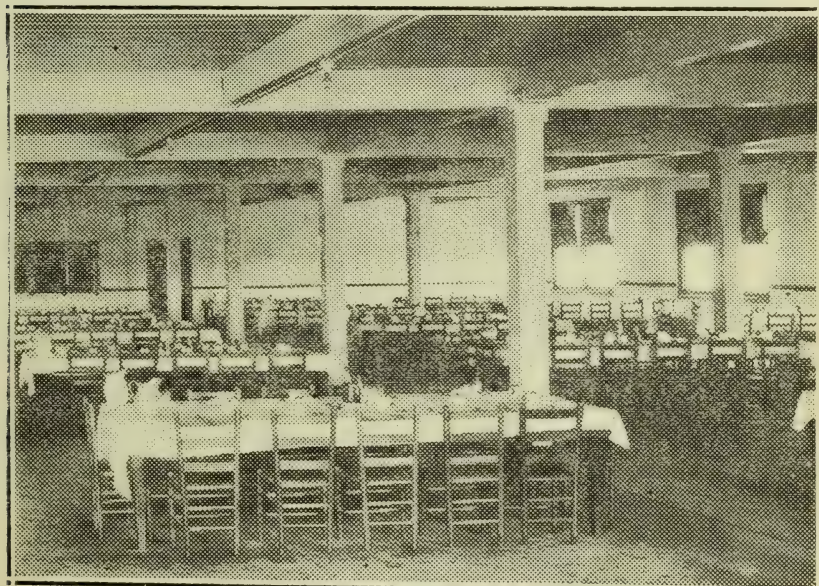


Fig. 2—A Section of a Dining Room in One of the Larger Schools. This Dining Room is Unusually Light and Airy as Well as Neatly Kept.

Land devoted to recreation, that is, campus and athletic fields, varies from 2 or 3 acres to 40 acres. The majority of schools have 5 acres for such purposes. All schools have football fields. All have, at least, one outdoor basketball court, and a number have as many as three. Ten schools make no provision for tennis. The other schools have from one to four courts. The football field is generally also used for baseball. However, eight months schools are usually out before baseball season. All agricultural high schools have an athletic program, even those in which funds are not provided by the county. This includes 15 schools, 8 of which raise money to meet deficits by donations, school plays, and sale of sandwiches and candy; 7 by charging all pupils enrolled an athletic fee.

Dormitories:

Number and Value

Table 2—Relation of Number and Value of Dormitories to Number of Individuals Living in Dormitories in 47 Agricultural High Schools of Mississippi During 1929-30.

Individuals per School	Schools in Group	Number of Dormitories					Total Value Dollars
		ForBoys	ForGirls	ForBoys andGirls	For Teachers	Total	
-							
29-50	15	15	12	3	1	31	381,000.00
51-100	19	19	17	2	0	38	633,000.00
101-327	13	15	15	0	0	30	1,002,000.00
Total	47	49	43	5	1	99	2,016,000.00

There are more dormitories for boys than for girls, for more boys than girls live in the dormitories. The fact that boys have more opportunity to work their way accounts partly for this difference.

There are five schools which have only one dormitory. In these the sexes are segregated by a partition through the middle of the building. One school has a small building which is used by the teachers. In this school, the superintendent, his wife, and the matron perform dormitory duties generally performed by the teachers.

There are a total of 99 dormitories or an average of about 2 dormitories per school. There is practically no difference in the total number of dormitories in schools of varying size but there is a difference in the value of dormitories. For instance, schools with a population of from 29 to 50 persons have an average of 2.07 dormitories with an average value of \$12,290.00 each; schools with a population of from 51 to 100 persons have an average of 2.00 dormitories with an average value of \$16,658.00 each; schools with a population of from 101 to 327 persons have an average of 2.31 dormitories with an average value of \$33,400.00 each.

Building values were: For schools housing less than 50, \$572.00 per person; housing from 51 to 100, \$471.00 per person; housing 101 to 327, \$499.00 per person. The fact that schools housing less than 50 are rarely housing the maximum, whereas, schools housing from 51 to 100 are usually housing the maximum, or even more, accounts for the difference in building cost per person in these two groups of schools.

These building costs per person are much lower than the standard of from \$1200.00 to \$2000.00 per person suggested by the Institution Economics Section of the American Home Economics Association. [4-p. 1]

Exterior of Dormitories:

The exterior of agricultural high school dormitories is generally kept in good repair. Only 17 of the 99 dormitories needed paint, and 6 reshingling. All dormitories were screened. The screens were, for the most part, in good repair.

Modern fireproof dormitories are gradually replacing the old frame type. Of the schools 50 per cent, however, still have one or more frame dormitories.

Interior of Dormitories:

The general appearance of the interior of the school dormitory is on the whole not as good as the exterior. The walls, flooring, and staircases in a number of dormitories needed attention.

Lighting and Heating: All dormitories are lighted by electricity. Dormitories in 24 schools are heated by steam, in 10 schools by stoves, in 3 schools by fireplaces, in 1 school by hot water, and in 9 schools by more than one of these methods. The latter group includes schools which are using an old dormitory to supplement one recently constructed. Thus the old dormitory for boys may be provided with stoves, the new dormitory for girls with steam heat.

Table 3—Relation of Plumbing Facilities in Dormitories to Number of Individuals in 47 Agricultural High Schools in Mississippi During 1929-30.

Individuals Per School	Schools In Group	Average Number Individuals Per:			
		Toilet	Shower	Bath Tub	Lavatory
29-50	number 15	8.5	12.8	19.0	9.3
51-100	19	13.8	17.3	32.0	11.6
101-327	13	9.3	20.2	19.1	4.0

Plumbing: From the above table it seems that schools housing less than 50 individuals have more plumbing facilities than schools housing from 51-100. This is due to the fact that schools with 50 persons or less are usually schools not caring for their maximum. Consolidation of schools has decreased in many instances the number of boarding students in agricultural high schools. This has meant vacant rooms and sometimes even vacant floors in girls' and boys' dormitories.

The plumbing facilities found in these agricultural high school dormitories do not meet the standard of 1 toilet to 6 boarders; 1 shower or bathtub to 6 boarders; 1 lavatory to 5 boarders set by the Institution Economics Section of the American Home Economics Association [4-p. 4]

The plumbing situation in schools housing over 100 as compared with smaller schools is better than indicated by Table 3. In the first place, plumbing in these larger schools is usually kept in better condition than in the smaller schools. In the larger schools one generally finds showers in the school building for boys and girls taking part in athletics. Many use these showers instead of those in the dormitory.

In dormitories of four schools, there are no sewer connections. One school does not have a shower or bath tub. These are, of course, in poor rural counties where such improvements have been delayed because of lack of funds and ignorance of the value of plumbing.

In a number of smaller schools, the only provision made for hot

water is the boiler connected with the kitchen range. Practically all hot water from this boiler is used in dishwashing. This means that hot water needed for other purposes such as baths and washing must be heated on the top of the kitchen range. Needless to say such an arrangement or lack of arrangement upsets regular kitchen routine.

Three schools do not have a kitchen sink. Two of these, however, have running water in the kitchen. Very few schools have a separate dishwashing room. Only a few have electric dishwashing machines. In many schools the following procedure is used in dishwashing: Waitresses get dishpans of water from the kitchen and wash and dry all dishes, glasses, and silver at their tables in the dining room. Better plumbing facilities would do more than any other one thing to make the dishwashing process, a process of cleaning rather than a process of spreading germs. It seems that schools feeding over one hundred could well invest in a dishwashing machine. The matron in one of the schools in which there is a dishwashing machine says, "We couldn't do without our dishwashing machine."

Bedrooms: The typical agricultural school dormitory has about 25 double bedrooms each of which has a double window and a floor area of around 190 square feet. In only a few cases are these rooms occupied by more than two persons. A few rooms have closets but the majority have built-in wardrobes. One of the new dormitories has lockers in each room. The ceiling lights (direct system) are used. The floors are wooden—either oiled, painted, or varnished.

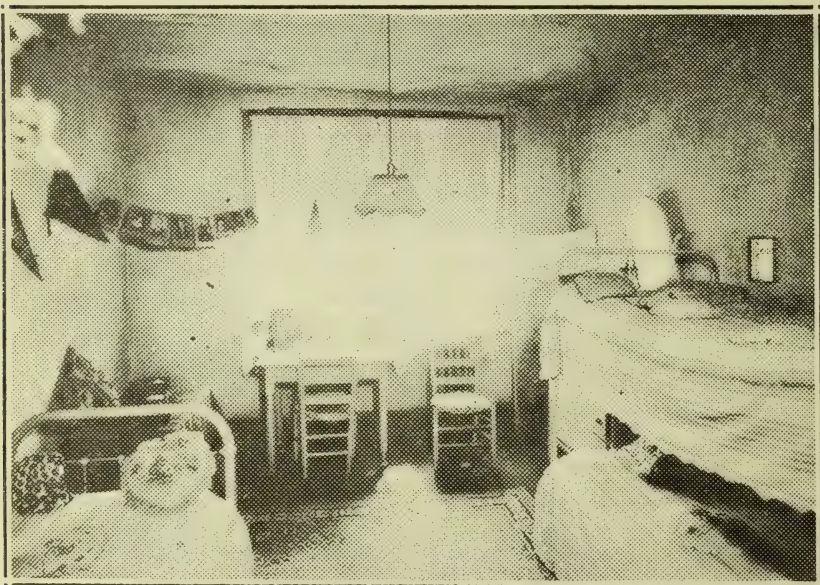


Fig. 3—An Attractive Bedroom in One of the Girls' Dormitories. Notice Linoleum Rug, Curtains, and Other Attractive Features.

The following bedroom furnishings are supplied by the school: a bedstead and mattress, a dresser, a table, and two straight chairs. A few schools furnish waste paper baskets, washstands, and bookshelves.

In 20 schools, both double and single beds are used, in 17 schools double beds, and in 10 schools single beds. In a number of the boys'

dormitories, the double-deck single beds are being used. In the majority of schools these furnishings are not supplemented to any great extent by the students.

A number of schools do not have a guest room. In only a few schools are the dormitories so crowded that a room cannot be spared for this purpose. In one such school guests stay in the Girls' Reserve Club room, in another in the hospital room. The matron of Lamar County Agricultural High School has converted a vacant room in the girls' dormitory into an attractive guest room, with the use of a little cretonne, paint, and varnish. This could be done in other schools.

Living Rooms: The living room and dining room form the social, recreative, or living area of a building. Thirteen agricultural high schools depend entirely on the dining room for such activities, as no living room is provided. In some of these schools the superintendent and his wife have an attractive living room and often invite the girls and boys in. This, however, does not take the place of a regular living room for students.

What of the character of the living rooms in the 34 schools that have them? This is best expressed by a description of their furnishings. The living room in the girls' dormitory usually contains a piano, a table, a settee, 3 or 4 rockers, a rug, and curtains. It is often used as a practice or music room during school hours. The living room in the boys' dormitory does not contain as much—often only a settee and rockers. There are phonographs in the living rooms of four dormitories; radios in the living rooms of three dormitories. About half of the living rooms have pictures on their walls, though copies of great paintings were found in only five. Book cases containing from 30 to 50 books of standard literature were found in 5 living rooms. Neither cut nor pot flowers were used to any great extent.

There are living rooms in 35 girls' dormitories and 7 boys' dormitories. The larger schools usually provide a room or two for clubs such as the Girls' Reserve and the Hi-Y. These rooms are furnished by club members.

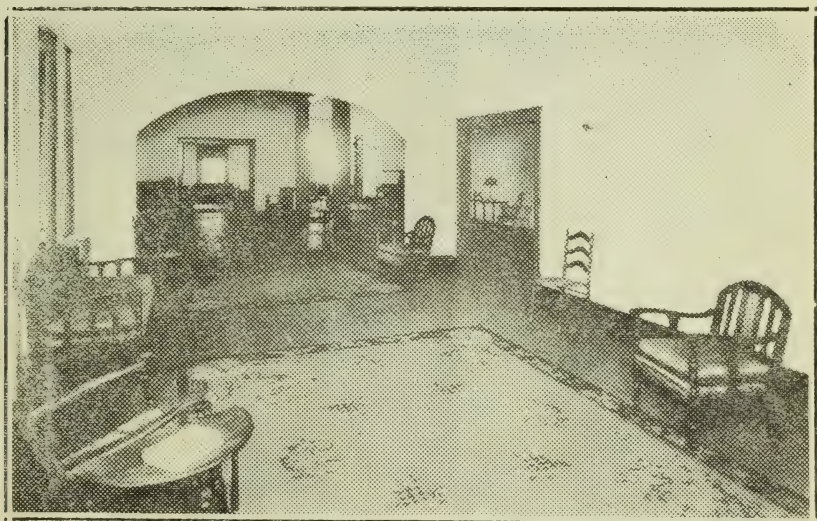


Fig. 4—A Living Room in One of the Girls' Dormitories. The Abundance of Comfortable Chairs and Settees Gives This Room a "Lived in" Air. Indirect Lighting and Pictures Would Add to its Attractiveness.

Dining Rooms: "The character of a dining room should above all be cheerful." Light and color are the two most important cheer factors. Basement rooms are not generally as light as rooms on first or second floor. Yet, in a number of agricultural high schools the dining room is located in the basement of one of the dormitories. The majority of dining rooms have sufficient window space but a number do not have eastern windows admitting the morning sun.

Color may be introduced into a dining room by draperies and flowers. Only 21 of the 47 dining rooms had curtains, the majority of which were white or cream. Curtains help to take away the bare appearance so characteristic of many institutional dining rooms. Plants or flowers also make a room more cheerful. Nine schools keep flowers on the tables in their dining room all the time and seven occasionally. Twelve schools use pot plants or window boxes. One school has a flower committee in charge of flower boxes and of getting flowers for the tables. Flowers from the campus, wild flowers, berries, and leaves are used.

Flooring in 31 dining rooms was wood, in 14 concrete, and in 2 linoleum. Walls of dining rooms located in frame structures were usually painted, in brick structures plastered. The number of windows varied from 3 to 26 with an average of 10. The number of tables varied from 3 to 21 with an average of 8. The seating capacity averaged ten per table. Thirty-six schools used cotton table cloths, 8 used oil-cloth table cloths, 2 used bare tables, and 1 used cotton doilies. Four schools used paper napkins, 4 used cotton napkins, and 39 used no napkins. Broken, mismatched, and insufficient dishes and silver were noted in a number of dining rooms visited. Sexes are rarely segregated. A matron or teacher, however, is usually seated at each table. The food is put on the table in serving dishes. This is passed around, each person serving him or herself. From 15 to 20 minutes is spent at each meal.

The table is the center of attraction and should therefore be attractive. Clean linen and attractive china and silver will help to make an attractive table. Jefferson County Agricultural High School uses doilies instead of table cloths, as it has been found that the expenditure for keeping clean doilies is less than that for clean table cloths. Smaller tables with fewer at each table, more attractive tables, and family service would mean greater opportunity for development of culture at the meal period.

Laundries: Only 3 schools operate a regular laundry. The charge per student varies from \$1.50 to \$2.00 a month. Boarders are not required to put clothes in these laundries.

A number of these schools have provided a laundry at one time or another but laundries in agricultural high schools are usually not successful. Boarding students go home every week or two. Many get their laundry done at home during these week-end visits.

Someone has well said, "The greatest difficulty a superintendent of an agricultural high school has to face is the idea that a student can live in a dormitory without any cash expenditure." A laundry fee does not "set well" with people having such an idea.

Seven schools have laundries operated by students. In one of these, Marshall County Agricultural High School, both boys and girls are divided into groups. The group of girls takes turns doing the washing for all girls and the group of boys for all boys. Each student does his or her own ironing. Students thus have an opportunity of using labor saving laundry equipment. This should have its effect in the home and neighborhood from which these students come. In 19 schools a room is provided in the dormitory for laundry work. The equipment usually consists of the following: a stove, tubs, boards, and irons. In the other 18 schools no special provision is made for laundering but students are allowed to use bath tubs and lavatories for washing clothing and the kitchen range for heating irons.

FINANCES

Handling Finances:

The superintendent of each school is responsible to his board of trustees for collection of board and expenditure of same. Ten of the 47 schools have clerical help. In 7 schools the matron keeps the books. In the other 30 schools, this job falls on the superintendent.

A number of superintendents said that the greatest problem they had in management of a dormitory was the financial problem or "making ends meet on the low board charged." A few spoke of a difficulty in collecting board. Agricultural high school dormitories are full of deserving boys and girls from poor homes.

The superintendent and matron buy the supplies; the matron the food supplies, the superintendent the other supplies. In a few schools, however, the superintendent buys the food supplies. School boards should pay enough to engage matrons capable of buying the food supply, for superintendents have enough to do without taking on the extra job of matron.

Board Rate:

Board is on a co-operative basis worked out by each individual school. At the time this study was made it varied from \$9.00 to \$15.00 per pupil per month with an average of \$11.63 per pupil per month. In only one school was board less than \$10.00. This was in Jefferson County Agricultural High School. Here a large porportion of the food used is raised on the farm, and an unusually good matron employed. In only 6 schools was board over \$12.75. The boarding department in these schools bore more of the dormitory expenses than usual. Board rate in 40 schools then varied from \$10.00 to \$12.75 or \$2.75 per month. No relation was found in rate of board and in number of boarders. This is probably due to the fact that board rate is at its minimum in all schools.

Students working for board get from \$1.50 a month towards board to full board. In 5 schools, teachers pay from \$.50 to \$2.50 more than do students. Board rate includes meals and lodging in all schools, water and lights in all but one, heat in all but two, and medical fee in one. No deduction is made in board in any of these schools for week-ends spent at home.

Board in an agricultural high school dormitory for a period of 9 months is about \$105.00. This means a cost of living for this period of around \$150.00. Surely, one cannot live at home for much less!

The boarding departments of these schools do not accept farm products in payment for board. However, 26 schools occasionally buy products such as syrup and potatoes from parents and the cash is applied on the child's board. This is not commonly done.

Items Included in Board Rate:

Repairs: The boarding department cares for all minor repairs in 2 schools and for part of the minor repairs in 4 schools. Major repairs in all schools and minor repairs in 41 schools are borne by the school district.

Fuel: In 7 schools fuel costs are entirely paid by the school district, in 11 schools partly by the school district and partly by the boarding department, and in 27 schools by the boarding department. In two schools an incidental fee takes care of fuel costs.

Lights and Water: In 31 schools, the boarding department pays for lights and water, in 8 schools, the school district takes care of these items, and in 7 schools, lights and water costs are paid partly by the school district and partly by the boarding department. An incidental fee takes care of lights and water in one school.

Furnishings: Furnishings are paid for entirely by the school district

in 41 schools and partly by the school district and partly by the boarding department in 6 schools.

Student Labor: Labor in connection with food service or general upkeep of dormitories is usually charged against the boarding department.

Salaries of Matrons: In 24 schools salaries of matrons are paid by the school district, in 12 schools by the boarding department, and in 11 schools partly by the boarding department and partly by the school district.

Wages: In 27 schools the wages of cooks and general helpers are paid by the boarding department, in 7 schools by the school district, and in 11 schools partly by the school district and partly by the board of education. Two schools used only student help.

Distribution of Expenditures:

A dollar paid into the boarding department of the 47 agricultural high schools during the school session of 1928-29 was used on an average as follows: \$.68 for food; \$.09 for student labor; \$.06 for matron; \$.05 for fuel; \$.05 for lights; \$.04 for wages; \$.03 for other expenses; and \$.05 for lights and water.

Expenditure for food varied from 41 per cent to 89 per cent of the total expenditure. Those spending a high per cent of receipts on food had somewhat better dietaries than those spending a low per cent.

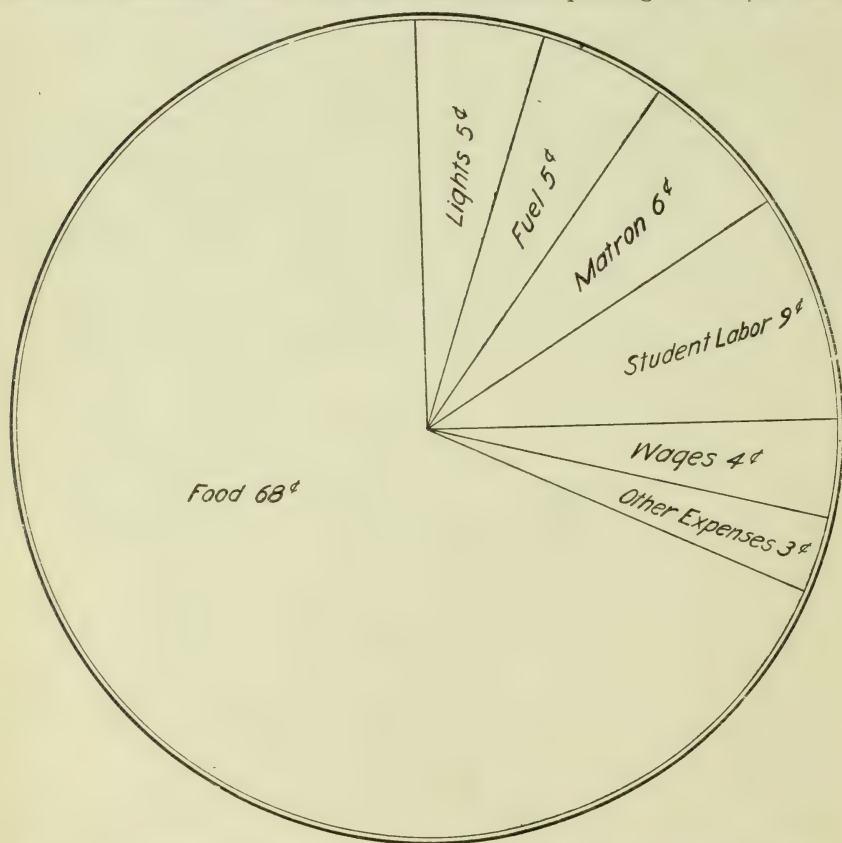


Fig. 5—Average Expenditure of a Dollar in the Boarding Departments of 47 Agricultural High Schools in Mississippi During School Session of 1928-29.

STUDENT LABOR

Table 4—Schedule of Boys Working for Part or Full Board in 47 Agricultural High Schools of Mississippi during 1929-30.

Type of Work	Total No. of Schools	Total No. of Boys	Total Amt. Pd. Students Per Month	Ave. Amt. Pd. Students Per Month	Ave. Time Per Student Per Day
			Dollars	Dollars	Hours
Sweeping and Cleaning	41	189	1130.25	5.54	1.9
General Farm Work	44	128	863.98	6.60	2.2
Milking	47	91	770.35	8.57	2.7
Firing	35	78	588.75	7.55	2.2
Kitchen Work	16	23	147.25	6.40	2.5
Lights and Water	13	20	149.50	7.48	2.4
Mail Carrier	12	13	61.30	4.71	1.7
Cutting Wood	5	10	89.00	8.90	2.9
Campus Work	7	10	73.25	7.33	2.0
Bell Boy	9	9	38.80	4.31	1.2
Carpenter	1	3	39.00	13.00	5.0
Plumber	3	3	26.00	8.67	2.5
Bus Driver	2	2	15.00	7.50	wh'n needed
Librarian	2	2	17.30	8.65	2.3
Bookstore	1	2	26.00	13.00	5.0
Mechanic	2	2	23.00	11.50	4.0
Office Work	1	1	5.00	5.00	2.0
Hauling	1	1	5.50	5.50	1.5
Asst. Agriculturist	1	1	12.00	12.00	3.0

Schedules for working boys vary greatly in different schools. This is largely due to the fact that in one school a certain type of work is done as practical labor, in another it is student labor. For instance, campus work is usually done as practical labor but in 7 schools student labor is used. Five hours of practical labor per week are required of every student in agricultural high schools of Mississippi in connection with courses in agriculture and home economics.

A large part of the farm work, as Table 4 shows, is done by student labor. By general farm work is meant care of stock, pigs, and chickens. Milking is always done by student labor. The majority of schools do not employ a janitor but use students for cleaning the school building and firing. Such work as cutting wood is usually an extra job. There is an opportunity in the majority of agricultural high schools for a number of

boys to earn part or all board by doing extra jobs such as: picking cotton, plowing, gathering potatoes, repair jobs, campus work, and hauling coal. The average amount paid for such work is 15 cents an hour. Many boys make their board or part of their board on these extra jobs.

The majority of schools employ 2 or 3 boys to do farm work during the summer months. From \$25.00 to \$50.00 a month and board is paid for this work.

Table 5—Schedule of Girls Working for Part or Full Board in 47 Agricultural High Schools of Mississippi during 1929-30.

Type of Work	Total No. of Schools	Total No. of Girls	Total Amt. Pd. Students Per Month	Ave. Amt. Pd. Students Per Month	Ave. Time Per Student Per Day
			Dollars	Dollars	Hours
Waitress, Dishwashing	34	250	1496.49	5.85	2.1
Sweeping and Cleaning	28	118	749.57	6.14	1.9
Kitchen Work	14	31	228.25	7.36	2.6
Churning	12	13	68.00	5.23	1.8
Librarian	7	7	37.50	5.36	1.7
Office	5	6	43.00	7.17	2.0
Mail	3	3	15.50	5.17	1.8
Grading Papers	1	3	15.00	5.00	1.0
Washing Table Linen	1	2	10.00	5.00	1.5
Telephone	1	1	5.00	5.00	1.0
Trays for Sick	1	1	5.00	5.00	1.5

As is true with the boys, so with the girls, certain types of work in one school are student labor in another practical labor. Girls are about as well paid for their work as are boys. There are, however, fewer jobs available for girls.

There is practically no extra or seasonal work for them. A few girls make extra money doing laundry work for teachers. In one school a few girls were hired to pick cotton. In 2 schools several girls were employed to can products from the school farm during the summer months.

An increased opportunity to earn part or full board would increase the number of girls boarding in agricultural schools. Girls are used in the kitchens of a few schools. This has not on the whole proved satisfactory, for the work is hard, hours long, and girls do not as a general rule cook as well as women regularly employed for this purpose.

The majority of superintendents and matrons spoke of having some difficulty "getting students to do student labor well." Eight superintendents and 13 matrons spoke of this as their greatest difficulty in managing the dormitory. Perhaps following the suggestion of the superintendent who said, "No student should be given work until he or she has been in the school 6 months and proven himself worthy of helping," would assist, at least partly, in solving this problem.

FOOD SERVICE

Source of the Food Supply:

A farm is maintained by every school for the purpose of teaching practical agriculture and home economics. Products from the farm are sold to the boarding department at cost. In 1929-30, agricultural high school farms produced all the milk used in 46 schools and part of the milk used in one school; all the butter used in 28 schools and part of the butter used in 15 schools; all the eggs used in 24 schools and part of the eggs used in 23 schools; all the meat used in 17 schools and part of the meat used in 30 schools; a part of the vegetables used in all schools; a part of the fruit used in 15 schools; all the cornmeal used in 7 schools; all the syrup used in 5 schools.

In many cases the school does not have adequate equipment for storing food produced on the farm, such as curing houses and cold storage plants. Sweet potatoes sometimes rot before they can be used. Meat must often be consumed the week it is killed.

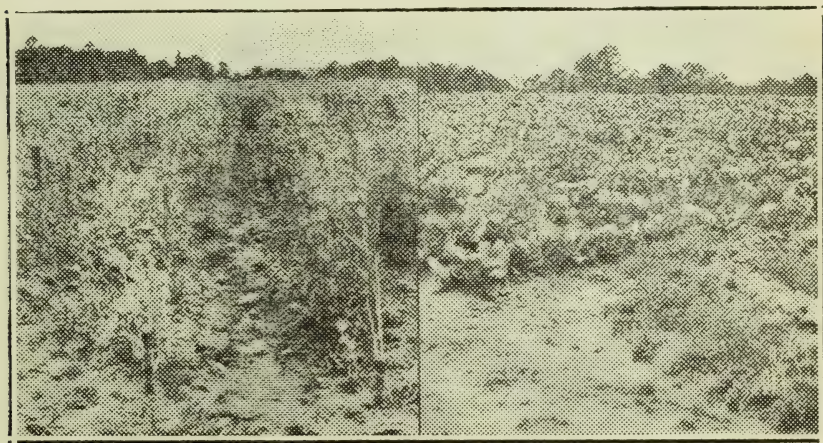


Fig. 6—Such Garden Plots as Found in This School Will do Much to Improve the Menus in Agricultural High Schools of Mississippi.

In a number of schools, the agriculturist and matron do not cooperate in making a food budget to be supplied by the school farm. That explains why the variety of vegetables grown by the school is often limited to 3 or 4 and why the 3 or 4 grown are often produced in such amounts that the school must serve them almost daily to consume them. Schools with splendid farms, however, have to supplement food products raised on these farms by purchase. Such foods are purchased wholesale. In schools in which menus are planned from day to day the matron is occasionally forced to purchase retail, otherwise there is no retail purchasing done.

Menu Planning:

A number of the matrons used the following form in planning menus:
Breakfast: Cereal, milk, main dish, biscuit, butter, coffee, syrup.

Dinner: Potatoes,* two other vegetables, cornbread, dessert.

Supper: Meat or substitute, cereal, fruit or syrup, biscuit, butter, milk.

Only 5 schools repeated the same dish on the same day each week. Matrons in 33 schools planned menus daily in 14 schools weekly. If old ideas in regard to dormitory foods are to be broken down, a definite time must be set aside each week for planning menus.

All matrons visited stated that one of their greatest problems was planning meals that were balanced and attractive on the board paid. Systematic meal planning, more adequate equipment for storage and preparation of food, and greater cooperation on the part of the matron and agriculturist will do much towards solving this big problem.

Protective Foods:

Table 6—The Use of Protective Foods in 47 Agricultural High Schools of Mississippi During 1929-30.

Item	Average Number Times Served per Week in the:		
	Fall	Winter	Spring
	number	number	number
Milk	10.2	9.4	11.7
Butter	10.3	9.1	11.5
Eggs	1.1	.2	3.1
Meat and Fish*	7.0	7.4	6.8
Vegetables**	12.7	8.7	9.2
Fruits	3.8	3.0	3.9

*Not including salt pork and bacon.

**Besides potatoes.

An estimate of the average number of times milk, butter, eggs, meat or fish, vegetables (besides potatoes), and fruits were served in the fall, in the winter, and in the spring, was obtained from the matron. This is summarized in Table 6. The amounts of these foods used on the day preceding the one on which the school was visited were also obtained. From this data the energy and nutrients received from these foods per man per day were calculated. (Tables A, B, and C in Appendix B). Such information should give, at least, a general idea of food consumption in agricultural high schools of Mississippi. A general idea was all that was sought in this study of living conditions as dietary studies have been made in several typical agricultural high school dormitories of this state [2].

*Sweet or Irish.

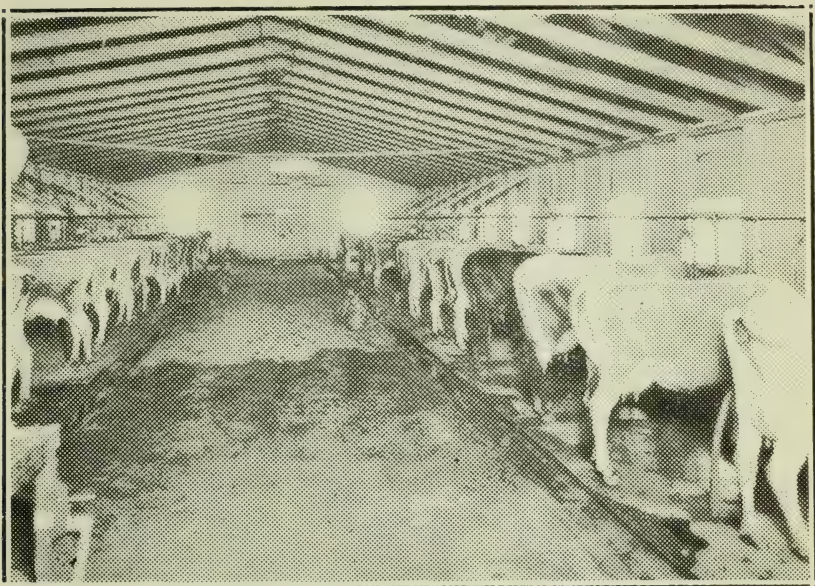


Fig. 7—These Milk Cows Furnish one of the Largest Agricultural High Schools in the State an Adequate Milk Supply.

Milk calculated in this way furnished about 8 per cent of the total energy requirement—meat, fish, and eggs also about 8 per cent. Rose [9-p. 423] suggests about 24 per cent for milk and 8 per cent for meat, fish, and eggs. Most of the milk used was buttermilk or skim milk, which has a much lower energy value than whole milk on which Rose based her estimate. This partly explains the low proportion of energy furnished by milk in these dietaries. About 8 per cent of the energy requirement was provided by butter. In a few instances it was purchased. It is doubtful whether schools with as low money allowance as these can afford to purchase butter.

Vegetables (except potatoes) furnished 5 per cent, fruits 2 per cent of the energy requirement. This means that fruits and vegetables together furnished only 7 per cent of the total energy requirement for the day. Potatoes doubtless contributed about 3 per cent. However, 10 per cent of the total energy from fruits and vegetables is much lower than the 18 to 20 per cent suggested by Rose [9-p. 423].

An analysis of protective foods used during one school day shows a shortage in quantities of milk, fruits, and vegetables. From a comparison of amounts of foods used with number of times served it seems probable that protective foods are generally served often enough but are not being provided or eaten in sufficient quantities.

Money Expenditures for Food:

In a study of "Nutritive Value and Cost of Foods Served to College Students" by Edith Hawley [3] cost varied from 34 cents per man per day to \$1.11 per man per day figured on the 1926 price level. In institutions spending from 40 to 45 cents per man per day students received a liberal diet. In this study, cost of food at the same price level is

estimated at 27 cents* per man per day. It would, doubtless, have been somewhat higher if it had not been for the fact that a number of students spend their week-ends at home.

An adequate diet can perhaps be provided at the above price under favorable conditions such as (1) maximum production of food products on the farm sold to the boarding department at cost (2) other foods purchased at wholesale (3) minimum waste (4) trained dietitians.

In cases where board rate is found too low to produce an adequate diet, it should be raised or the school board should be induced to take care of more of the dormitory expenses.

Food Consumption of Dormitory and Non-Dormitory Students Compared:

How does food consumption of students in these dormitories compare with that of students living at home? Are dormitory students any better or any more poorly fed? In order to answer this question a blank was given to each student in one or more classes of every agricultural high school. Blanks were distributed in classes containing both boys and girls and both dormitory and non-dormitory pupils. In this, the "Food Consumption" blank (see Appendix B), they were asked to record: whether or not they boarded in the dormitory, name, age, school, date, and foods, number of servings of each, eaten on yesterday, at breakfast, between breakfast and dinner, at dinner, between dinner and supper, at supper, and between supper and bedtime. Sunday's record was avoided by not distributing the blanks on Monday. 769 satisfactory records were obtained from dormitory students, 775 from non-dormitory students.

With such a method only a rough estimate of food eaten is possible. Hence, students have been placed in three groups A, B, and C. Group A comprises all pupils whose food consumption, it seemed fairly certain, included all necessary factors; group C includes pupils whose food consumption just as certainly failed to meet these needs; group B includes the pupils whose diets could not clearly be assigned to class A or class C.

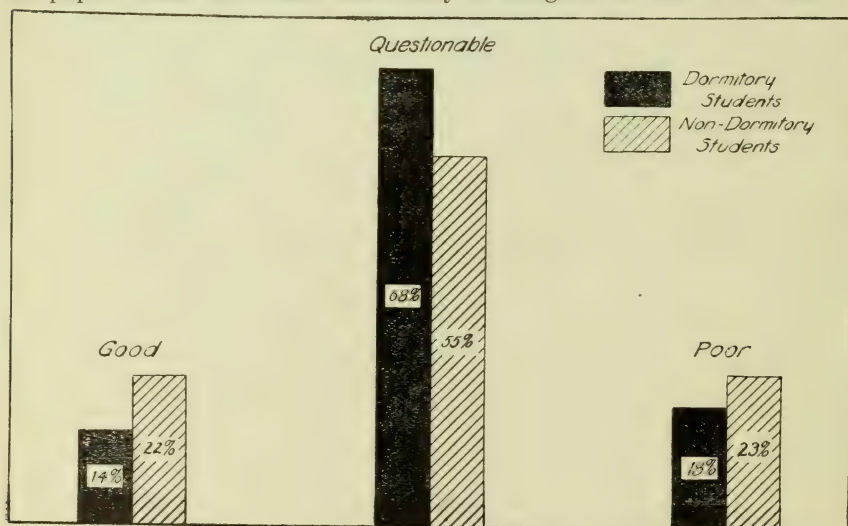


Fig. 8—Percentage of Dormitory and Non-Dormitory Pupils Whose Food Consumption was Good, Questionable, and Poor.

*Cost of food at time study was made averaged 26 cents per man per day.

According to this classification (Fig. 8) 86 per cent of the dormitory students and 78 per cent of the non-dormitory students failed to consume adequate diets. Good and poor food consumption was more often found among the non-dormitory group, questionable consumption among the dormitory group.

Dormitory students did not consume as much milk as non-dormitory students (Fig. 9). An insufficient quantity of milk was the reason so many dormitory students were put in groups B and C. These data do not, of course, include milk used in cooking. It seems, however, even with a generous allowance for cooking, the average pupil should have had 3 glasses daily for drinking.

Seventy-three per cent of the dormitory students and 42 per cent of the non-dormitory students did not have eggs on the day studied (Fig. 9). This does not, of course, include eggs used in cooking. Nutrition authorities generally recommend eggs three times a week for school children. The majority of boarding departments did not meet this standard. These records, however, were for the most part taken when egg production was low, that is, in the fall and winter. Meat and fish were used much more often by both groups than were eggs. Only 28 per cent of the dormitory students and 33 per cent of the non-dormitory students did not have meat or fish on the day studied. There were more non-users and excessive users of meat in the non-dormitory group.

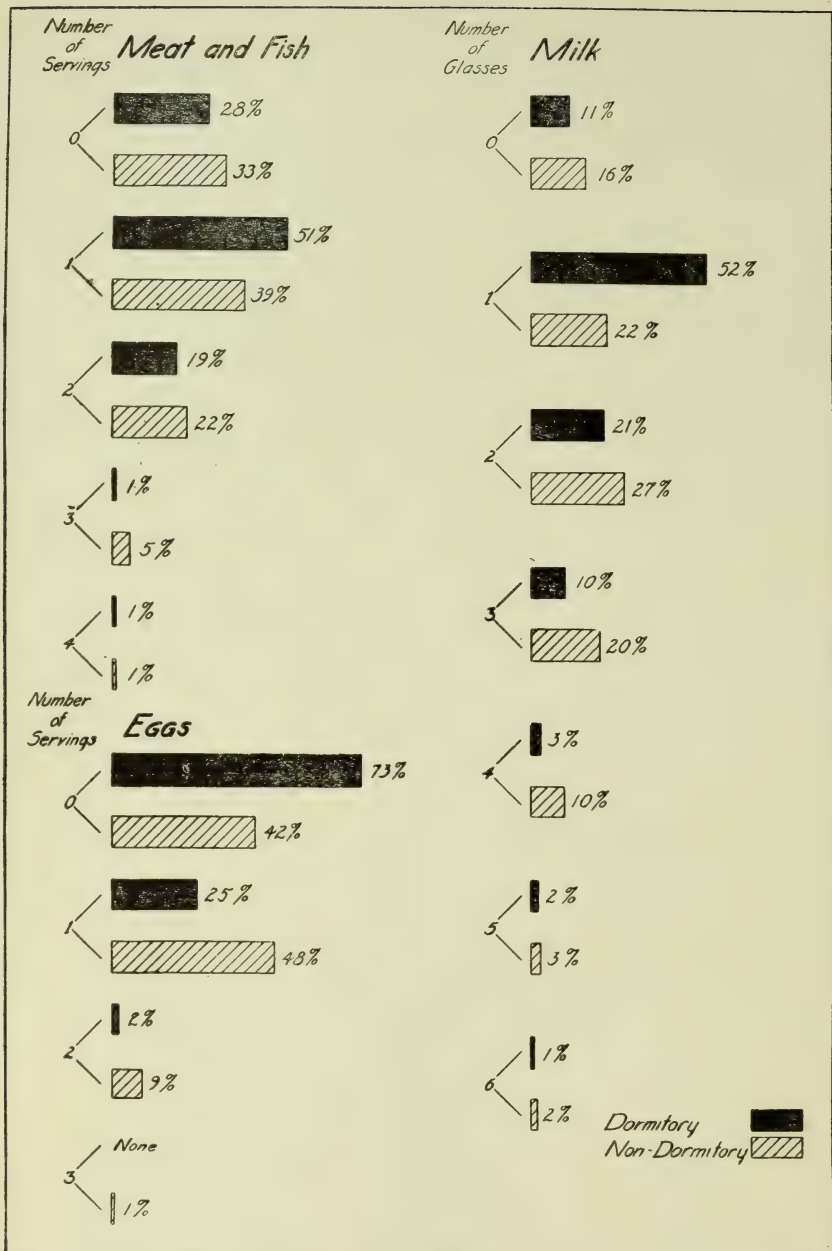


Fig. 9—Percentage of Dormitory and Non-Dormitory Students Who had None, One, and More Than One Serving of Meat or Fish, of Eggs, and of Milk During One Typical School Day.

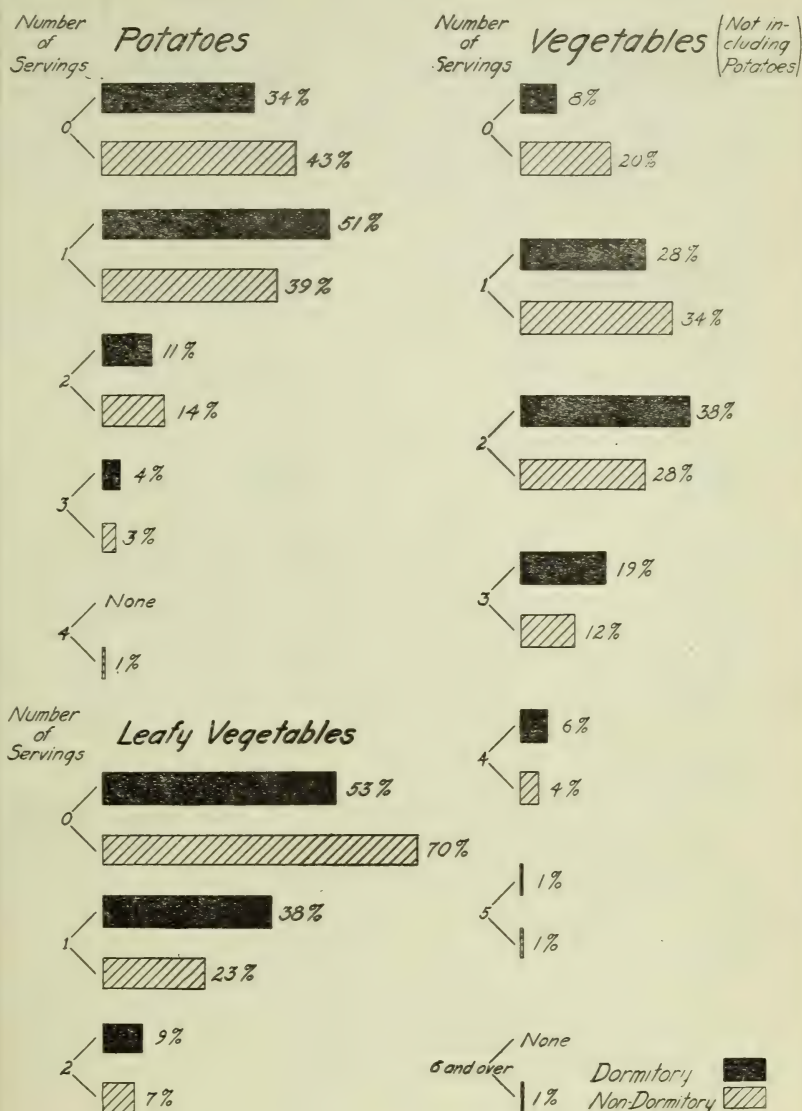


Fig. 10—Percentage of Dormitory and Non-Dormitory Students Who had None, One, or More Than One Serving of Potatoes, of Leafy Vegetables, of Vegetables (not including potatoes) During One Typical School Day.

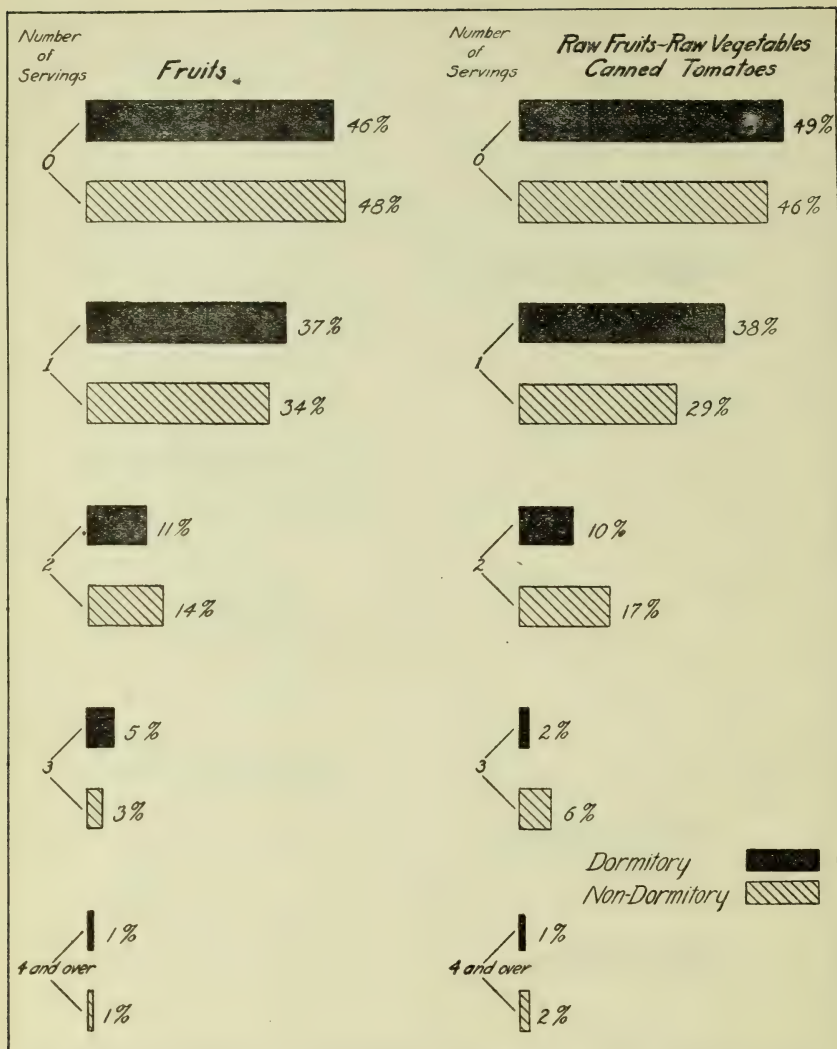


fig. 11—Percentage of Dormitory and Non-Dormitory Students Who had None, One, or More Than One Serving of Fruits, and of Raw Fruits, Raw Vegetables, or Canned Tomatoes During One Typical School Day.

Vegetable consumption among dormitory students was on the whole better than among non-dormitory students (Fig. 10). Dormitory students averaged about one serving of potatoes and about two servings of other vegetables per day. Only 47 per cent of the dormitory students and only 30 per cent of the non-dormitory students consumed leafy vegetables on the day studied. Leafy vegetables are especially valuable for their mineral content. Fruit consumption was low among both groups (Fig. 11). Forty-six per cent of the dormitory students and 48 per cent of the

non-dormitory students did not consume any fruit on the day studied. Fruit consumption was on the whole better among non-dormitory students. This was due to the fact that non-dormitory students often brought fruit in their school lunches.

Raw fruit, raw vegetables, or canned tomatoes should be provided in order to insure getting sufficient amounts of vitamin C. Forty-nine per cent of the dormitory students and 46 per cent of the non-dormitory students did not consume any of these foods on the day studied. This requirement is one of the many reasons why the matron and agriculturist of a boarding department should make a food budget. One finds little money to purchase fresh fruit and fresh vegetables on the low board charged.

Seventy-two per cent of the dormitory pupils and 79 per cent of the non-dormitory pupils did not consume a whole-grained bread or cereal on the day studied. Nutrition authorities usually recommend two servings per day. In some cases they were doubtless served but not eaten. Whole-grained breads and cereals are not generally popular.

Sixty per cent of the dormitory students and 62 per cent of the non-dormitory students did not have coffee on the day studied. One school kept down coffee consumption by charging 50 cents extra board per month for it.

ACTIVITIES OF DORMITORY AND NON-DORMITORY STUDENTS COMPARED

A time for sleep, a time for work, a time for play are important in the life of growing boys and girls. Therefore, to thoroughly understand living conditions of a group one must understand the activities of that group.

The day in an agricultural high school usually begins at 6:00 A. M., with the rising bell and ends at 10:00 P. M., with the light bell. Breakfast is generally served at 7:00 A. M., dinner at noon, and supper at 6:00 P. M. Meals are served promptly. Penalties are usually imposed on students late for meals. School starts around 8:30 A. M., and is usually out by 3:15 P. M. Study hour generally lasts from 7:00 P. M. to 9:30 P. M.

Just how do boys and girls living in the dormitories of agricultural high schools of Mississippi spend their time? Just how does this expenditure differ from time expenditure of other students?

In order to answer these questions an "Activities" blank was given to each student in one or more classes of every agricultural high school. Blanks were distributed as were the "Food Consumption" blanks only in classes containing both boys and girls and both dormitory and non-dormitory pupils. In this blank (see Appendix B) students were asked to record: whether or not they boarded in the dormitory, name, age, school, date, and activities on yesterday. 738 satisfactory records were obtained from dormitory students, 759 from non-dormitory students. No attempt has been made to score these blanks but tabulations have been made of time given to sleep, exercise, work, and study outside school hours by students in these two groups during one typical school day.

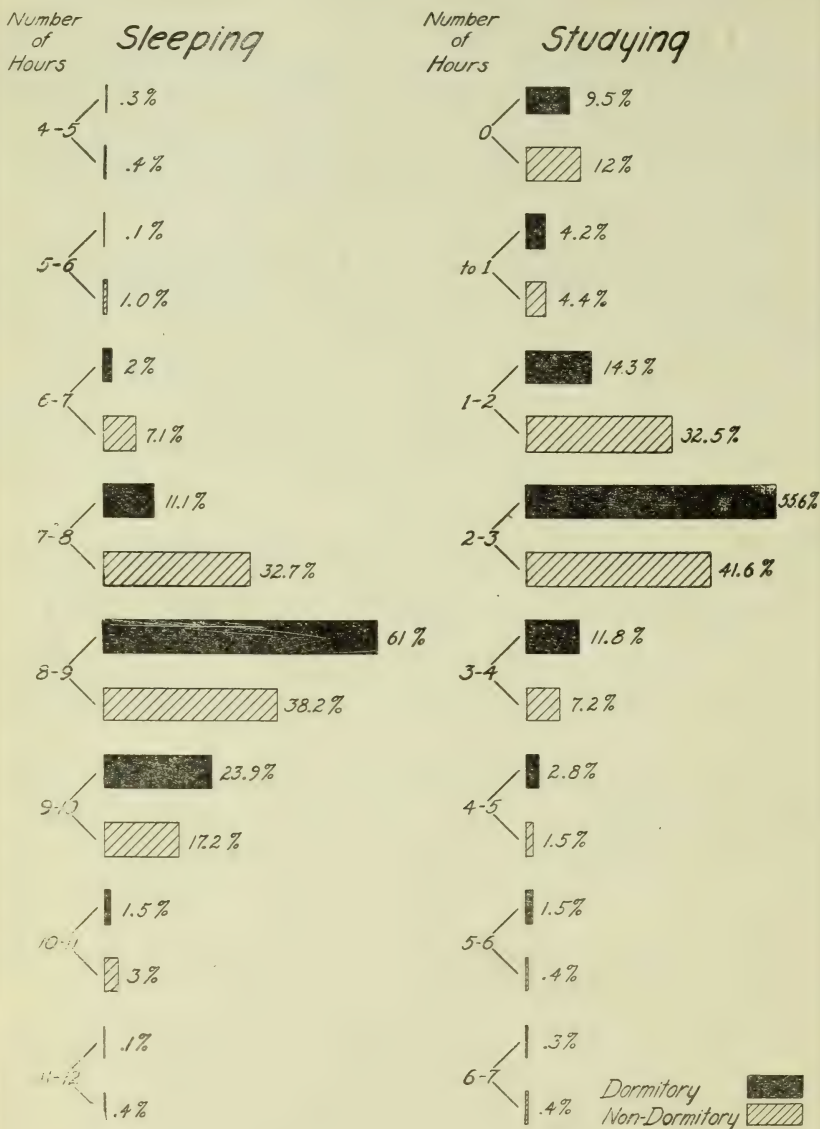


Fig. 12—Percentage of Dormitory and Non-Dormitory Students Who Spent Four or More Hours (outside of school hours) in Sleeping and Who Spent no Time, One Hour, or More Than One Hour (outside of school hours) in Studying During One Typical School Day.

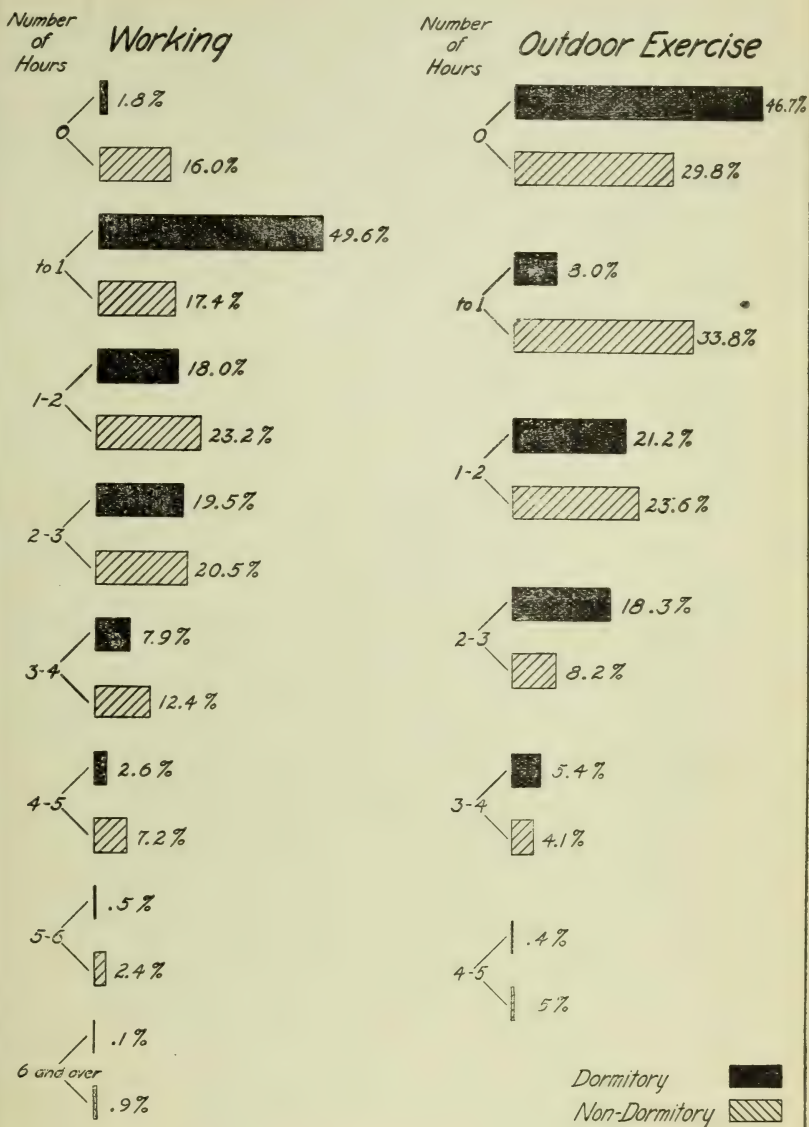


Fig. 13—Percentage of Dormitory and Non-Dormitory Students Who Spent no Time, One Hour, or More Than One Hour (outside of school hours) in Work and in Outdoor Exercise During One Typical School Day.

Of the dormitory students 13.5 per cent, of the non-dormitory students 41.2 per cent got less than 8 hours sleep (Fig. 12). Regular hours for going to bed and getting up observed in these dormitories, without a doubt, account for the greater amount of time spent in sleep by dormitory students.

Fig. 12 also gives the time spent in study outside school hours by the dormitory and non-dormitory group. Regular study hour is observed in all agricultural high school dormitories. In the majority of schools, pupils study in their bedrooms; in a few, in the study hall. Quiet is observed during study hour. Every effort is made to get pupils to spend this time studying.

Dormitory students spent more time in study than non-dormitory students. Atmosphere in the modern home is not always conducive to study. More time spent in study partly explains why the average dormitory student makes better grades at school than does the average non-dormitory student.

Fig. 13 gives time spent in outdoor exercise by dormitory and non-dormitory pupils. It includes time spent walking to and from school. This explains the large number of non-dormitory students taking outdoor exercise. A number of students coming to school on trucks have to walk quite a distance to reach the truck route. Comparatively few non-dormitory boys and girls played tennis, basket ball, or the like. High school teams are made up almost entirely of dormitory students for "school trucks leave right after school and students have no time for practice." School officials often mentioned the fact that dormitory students had more time for extra-curricula activities than did other students. It was the dormitory student who was on the team or in the class play. However, as shown by Fig. 13, there were many dormitory students who did not take outdoor exercise. This was especially true of girls. Many superintendents are seeking to remedy this condition. At Lamar County Agricultural High School the superintendent has arranged for a teacher to take the dormitory girls on a hike each afternoon. In Tallahatchie County Agricultural High School volley ball courts were provided and all dormitory students urged to come out for a 20 to 30 minute practice after dinner and supper.

Work outside of school hours (Fig. 13) included for the dormitory students: care of their bedroom, practical labor, and student labor. Boys did most of their practical labor in school hours, girls outside school hours. Practically all student labor was done outside school hours. Work outside of school hours included for the non-dormitory students: housework, farm work, and the like.

Of the dormitory students, 30.6 per cent worked over 2 hours a day. Of the non-dormitory students, 43.4 per cent worked over 2 hours a day. Working over two hours a day generally meant less time given to sleep, or exercise, or study. Two-thirds of the non-dormitory students work at least an hour a day. This does not agree with the idea which many have of modern youth.

HEALTH CONDITION

Protective Measures:

A pure and abundant water supply and screens against disease-carrying insects are two health protective measures that should be provided by every institution. Thirty-five schools had deep wells, 3 springs, and 9 obtained water from the local town supply. The three schools obtaining their water supply from springs had the water tested, one every three months, one every six months, and one yearly. Nine other schools had their water tested. All dormitories were screened.

Sickness in the Dormitory:

With the exception of an occasional epidemic, there is very little sickness in agricultural high school dormitories. In 1928-29, 14 schools had mild flu epidemics, 5 epidemics of measles, and 3 epidemics of mumps. Only 12 schools have isolated rooms to care for sick students.

In Tallahatchie County Agricultural High School, a student is given \$5.00 a month to prepare trays for all sick students, thereby, relieving the matron of a detailed job in order that she may give her undivided attention to meal service.

A medical fee is charged in only 13 schools. In the other schools each student is responsible for any bills which he or she might make during sickness. All superintendents feel that medical service by a physician employed to look after students is much more satisfactory. Parents in the majority of schools, however, object to a medical fee. Schools not employing a physician, keep a few simple home remedies on hand. The matron treats all minor illnesses. Therefore, in such schools, the majority of students get through the year without any cash expenditure for sickness.

In twenty-five schools attendance of dormitory pupils is better than non-dormitory pupils. This cannot be attributed to better health of dormitory pupils for in the few schools where health examinations are conducted, dormitory pupils are in no better physical condition than non-dormitory pupils. Non-dormitory pupils are often kept at home to do extra jobs or because of bad weather. Better school attendance of dormitory pupils is another reason why they make better grades than other pupils.

CULTURAL AND SOCIAL INFLUENCE IN THE SCHOOL DORMITORY

Through Teachers and Matrons:

One superintendent has said, "The dormitory is a splendid medium for training pupils in good habits and cultural traits." Pupils living in the school dormitory are under direct supervision at all times. They have closer personal contact with their teachers than do other pupils. Many a boy and girl in these schools has been inspired to higher standards of conduct and cleanliness by some fine teacher or matron. Dormitory pupils are checked up from 3 A. M. to 8 A. M. as well as from 8 A. M. to 3 A. M.

The dormitory is the first real home a few of the students have ever known. Therefore, some must be loved as well as trained. In Leake County Agricultural High School, the superintendent and his wife give a graduating present to all boys and girls without a father and mother. A teacher in one of these schools said, "Although I get a good salary and have few expenses, I never save a penny. One can't save where they see earnest, studious boys and girls who need a helping hand." A superintendent of an agricultural high school said, "There would be no end to the service a dormitory could render if all teachers and matrons would give themselves to the dormitory." The dormitories are indeed fortunate in having some such teachers and matrons.

Through Contact With Students:

A dormitory student learns even more from his or her companions than from the faculty. He or she learns the lesson of self reliance, the

lesson of "give and take." Dormitory life in an agricultural high school helps to prepare one for college life. One big awkward boy 18 years of age enrolled in one of the agricultural high school dormitories. When he went down to his first meal, he found a table napkin at his place, the first he had ever seen. He tucked it in his shirt front for he did not know what else to do with it. This same boy asked the matron to please tell him what to say and how to act when he met girls. After three years in the dormitory, this boy is a model for all the younger boys of the school of what a boy should be and do.

The most attractive girl in one of the dormitories visited caused smiles of amusement and pity when she first came as a boarding student. Numbers of cases similar to these two could be cited.

The school dormitory places emphasis on worthwhile amusements. It does not allow students to take part in many outside affairs. Boys and girls are not usually allowed to go to town more than twice a week. Girls are always chaperoned to town. In towns in which there are moving picture shows, students are not allowed to go more than once a week and then only when the picture is well recommended. Dancing with the opposite sex and card playing are forbidden. Visiting in homes in the community is usually forbidden. Games, singing, and music are permitted in all dormitories during leisure hours.

In many schools, students are allowed to spend every other week-end at home. Some schools have no definite rule but permit students to go home when parents request. Week-ends spent in the dormitory offer a chance for social development, a chance for social intermingling of sexes. Yet this very situation often makes what is called "the co-ed problem." The "co-ed problem" seems to be greater in schools where boys and girls are allowed few or no social hours. One superintendent said, "I let the boys and girls have dates and see each other as in the home and have no trouble. Too much repression makes the "co-ed problem." Dormitory boys and girls are usually allowed to go together to school affairs such as programs, games, and parties. A number of schools hold a definite social hour, usually Saturday night or Sunday afternoon. In one school visited, the social hour was planned and conducted in such a way that it meant not only a good time but social development. Pupils in this school were unusually cordial and poised in meeting strangers.

Through Musical, Artistic, and Literary Advantages:

The school dormitory does not have much to offer the student in the way of the musical and the artistic. Only a few dormitories are provided with phonographs and classical records, or with a radio. Practically all girls' dormitories, however, are provided with a piano. Here one rarely finds beautiful pictures, beautiful furniture, beautiful draperies.

On the other hand, dormitory pupils have an opportunity of reading some of the world's best literature, just by going next door to the school library. The agricultural high school library contains an average of 1000 volumes, varying from 150 volumes to 3300 volumes, literature predominating. It contains an average of 15 magazines, varying from 0 to 70.

RELIGIOUS INFLUENCE IN THE SCHOOL DORMITORY

The religious influence exerted in the dormitories of the 47 agricultural high schools in Mississippi equals, if not surpasses that found in the most godly rural home. In choosing faculties for these schools, school boards consider moral as well as educational qualifications. All dormitory students are required to attend the Sunday school and the church of their choice. The majority of students attend young people's

unions held in the churches each Sunday evening. Twelve schools have a 15 or 20 minute vesper or prayer meeting service each day in the dormitory. Devotionals are held at chapel, and at Hi-Y and Girls' Reserve Meetings.

SUMMARY AND CONCLUSIONS

In the light of this study, which has attempted to investigate and assemble all the available information concerning dormitories in the 47 agricultural high schools of Mississippi, the following facts are of special interest:

1. 4018 individuals: 3467 students, 459 teachers, 54 matrons, and 35 other persons are living in the agricultural school dormitories of Mississippi.

2. Sixty-five per cent of the matrons have had no training in home economics, 26 per cent only a summer or correspondence course in home economics, and 9 per cent one or more year's training in home economics.

3. There is little or no relation between the home economics departments and boarding departments of these schools.

4. All schools have grounds available for campus and athletic fields. Forty per cent of these grounds were judged good in appearance from the viewpoint of freedom from trash, landscaping, and drainage. Much progress is being made in this direction.

5. The majority of schools have two dormitories, one for boys and one for girls. Building values do not reach the standards set by the Institution Economics Section of the American Home Economics Association.

6. Board rate varies from \$9.00 to \$15.00 per boarder per month with an average of \$11.63. Sixty-eight per cent of this goes for food, 9 per cent for student labor, 6 per cent for matron, 5 per cent for fuel, 5 per cent for lights and water, 4 per cent for wages, and 3 per cent for other expenses.

7. 588 boys and 435 girls or 30 per cent of the students have regular employment in these schools. A number of other students are given odd or seasonal jobs. Boys have more opportunity to earn money than do girls.

8. Farms are maintained in these schools for the purpose of teaching practical agriculture and home economics. These farms furnish a large part of the food used in some schools, a smaller part in others.

9. Amounts of milk, butter, eggs, meat, fish, vegetables, and fruit used during one typical school day were obtained from all boarding departments. An analysis of these records shows a shortage in quantities of milk, fruit, and vegetables used.

10. Cost per man per day amounted to 26 cents. This was much lower than costs found in similar studies among college students. The facts that many agricultural high school students spend their week-ends at home and that a part of the food used is raised on the school farms and sold to the boarding department at cost doubtless account for a part of this difference.

11. Records of food consumed during one typical school day by 739 dormitory and 775 non-dormitory students showed more good and poor diets in the non-dormitory group, more questionable diets in the dormitory group. An insufficient quantity of milk was the reason for so many dormitory students being placed in the questionable class.

12. Records of activities during one typical school day by 738 dormitory and 759 non-dormitory students showed that more time was spent in sleep, study, and athletics by dormitory pupils. Non-dormitory pupils spent more time in work.

13. Health conditions in these dormitories are good.

14. Dormitory students develop culturally and socially through daily contact with instructors, matrons, and fellow students. This is especially true in schools where there are not too many restrictions.

15. Agricultural high schools do not as a whole place enough emphasis on the artistic or the beautiful.

16. The religious influence in these dormitories is excellent.

The agricultural high school dormitories of Mississippi are housing hundreds of rural boys and girls at a very low cost. This is, in the majority of respects, being admirably done. Dormitory students have an excellent opportunity for study, for extra-curricula activities, for social, cultural, and religious development. However, in many cases these students are failing to get sufficient quantities of protective foods such as milk, vegetables, and fruits. This can be easily remedied by greater and more varied production of food on the school farm and by putting trained dietitians in charge of food service. In some cases, they are failing to get a vision of the artistic, so poorly is their dormitory equipped, so little the effort to make even that equipment attractive.

APPENDIX A

Inexpensive Hints for Improving Dormitory Life

The essentials of good dormitory life just as the essentials of good home life consist in the occupants of that home doing their best to make it a better place in which to live, a place that will protect life and health, a haven of rest from daily vexations, an inspiration to better living. Not only must the physical needs of the occupants be satisfied but the home must be attractive. Beauty in every form has an influence for good. Children especially are wonderfully affected for good or ill by their surroundings. For this reason, the agricultural high school dormitories of Mississippi should be places of beauty.

Several of the dormitories have lovely natural settings, others are not so fortunate. Attractiveness of dormitories is best accomplished by having them rest in a mass of trees and shrubs. All objectionable buildings or objects should be hid by means of trees and shrubbery. Trees and shrubs can be selected from the woods or roadsides. Oaks, maples, elms, red bud, dogwood, wild haw, holly, and the like may be used. With trees, shrubs, vines, and flowers pleasing contrasts can be produced.

Beauty on the inside as well as the outside of these dormitories is possible at low cost, beautiful living rooms, dining rooms, and bedrooms.

Someone has thus described a living room, "First a book case, with a great many books in it, a good lamp; then, several chairs that you can move, and a couch that you can sit or lie upon. You will want pictures such as you can afford, not 'stop gaps,' but copies of real works of art upon the wall. Then there will be a fireplace and if we are musical we shall need some musical instrument. That is quite all we want and we can add little to these necessities without troubling ourselves and hindering our work, our thought, or our rest."

Good pictures and books give tone to the living room. One good picture is more desirable than several poor ones. Excellent reproductions of the world's masterpieces, both modern and classic are available today. Catalogues of copies may be obtained from art companies. In one city school, the parent teacher organization makes a practice of giving one

picture a year to the school. This would be an excellent project for parent teacher organizations in agricultural high schools. Built in book shelves can be made by students in manual training classes or students especially talented in hand craft. These should harmonize with the other furnishings and should be placed under windows, beside doors, and in various recesses and empty spaces where they will add to the charm of the room. The book shelves can easily be filled with books donated by the school library, school officials, and pupils. Only good literature should be used for this purpose.

As said before, the dining room should be bright and cheerful. Bright draperies and flowers will take away the bare appearance so characteristic of many institutional dining rooms. Curtains belong in the dining room as well as the living room. Side drapes and valances may be of cretonne or unbleached muslin dyed any shade desired, glass curtains of cheese cloth, voile, or scrim. Flower boxes or fresh flowers or both should be kept in the dining room throughout the year. Keeping flowers in the dining and living rooms would serve as an excellent practical labor project as well as enhance the attractiveness of these two rooms.

Many boys and girls living in agricultural school dormitories have taken no interest in making their bedrooms attractive. Perhaps, a "better bedroom contest" including boys as well as girls would stimulate their interest. Such a contest would involve little expense. Probably a gallon of paint and a few yards of material would be sufficient to transform an ordinary room into an attractive room. The old dingy metal beds and furniture common in a number of school dormitories could be painted, curtains and rag rugs made. The furniture in girls' rooms should be finished with a light paint, in the boy's with a dark paint. Dotted swiss, cretonne, and muslin are suitable materials for curtains in girls' bedrooms, denim or repp in boys.' Rag rugs are appropriate for both.

The agricultural high school dormitory is a fine place for social development. In some dormitories, school officials are taking full advantage of this opportunity, in others they are not.

The young man or woman who does not know the rules of social life is frequently ill at ease, awkward, confused, and unable rightly to exert powers of speech or action. The meal hour can be used for teaching valuable lessons in table etiquette. Ten minute talks on this subject once or twice a month after supper by members of the faculty, or pupils, smaller tables, and longer meal periods (especially at supper) would give more time for social development. Much more, however, can be gained through an example set by cultured instructors and through a correctly appointed table. This is one reason that napkins should be used. Napkins as well as all the other equipment of a correctly appointed table should be made available to agricultural high school students. One would get more social development from eating on a table with attractively painted oilcloth doilies than on a table of worn white oilcloth. Socials and teas are another means of social development. At first these affairs may be rather stiff but after a time or two under right supervision they will be enjoyable affairs as well as a means of bringing out the self-conscious boy and girl and of subduing the over-boisterous.

The dormitory should mean physical as well as artistic and social development. Physical development is best brought about by serving an adequate diet which includes milk, vegetables, fruits, eggs, whole-grained cereals, and meat (see "Food Selection Score Card" in Appendix B). Food consumption of a school may easily be checked by keeping a record of the amounts of each food used over a period of time. Divide these quantities by the total number of persons served and total number of days. The final quotient will represent the per capita per day issue. These can

be checked against the perfect score of each food in "The Food Selection Score Card." If an adequate diet is being served then no changes need be made in production. On the other hand, if there is a milk or a fresh vegetable shortage, then more cows should be bought or more land given to lettuce, cabbage, and the like. Getting the right foods eaten in sufficient quantities is often even a bigger problem than providing the right foods. Agricultural high school matrons have an opportunity of doing some real food educational work. Let us hope they will not shirk this, their great opportunity.

APPENDIX B

Score Cards, Scales, Supplementary Tables, and Forms Used

FOOD SELECTION SCORE CARD*

Food	For	Amount	Perfect Score Score	
Milk	Children under 18	1 to 2 cups	10	20
		2 to 3 cups	15	
		3 to 4 cups	20	
	Adults	1 and less than 2 cups	10	20
		At least 2 cups	20	
Vegetables	Children and Adults	Potatoes	5	20
		Potato and 1 other	10	
		Potato and 2 others	15	
		1 raw vegetable	5	
		4 or more times weekly		
Fruits	Children and Adults	1 serving	10	20
		2 servings	15	
		1 fresh or tomatoes	5	
Whole Grain—	Children and	1 serving	10	15
Cereal or Bread	Adults	2 servings	15	
Eggs, Meat, Cheese,	Children and	1 serving of one	10	15
Dry Peas, or Beans	Adults	1 serving of two	15	
Water	Children under 18	1 qt.	5	10
		1 ½ qts.	10	
	Adults	1 ½ qts.	5	
		2 qts.	10	

Deductions:

Children: 1 cup of tea or coffee 10; 2 cups of tea or coffee 15; sweets between meals 10. Adults: Over 2 cups of tea or coffee 10; sweets between meals 10

*Mississippi Agricultural Extension Service.

Scales tentatively adopted by the Bureau of Home Economics expressing the allowance of nutrients for various members of a family group* in terms of the standards set for an adult man, in which 1.0 represents 3000 calories, 67 grams protein, 0.68 grams calcium, 1.32 grams phosphorus, 0.015 grams iron.

	Age of Individual	Energy		Protein		Calcium	Phosphorus	Iron
	Years	Male	Female	Male	Female			
Children	3 yrs. or less	0.4	0.4	0.7	0.7	1.5	0.7	0.4
"	4 to 8	0.6	0.5	0.9	0.9	1.5	0.8	0.6
"	9 to 11	0.7	0.7	1.1	1.1	1.5	0.9	0.8
"	12 to 15	0.9	0.9	1.3	1.2	1.4	1.0	1.0
"	16 to 17	1.1	0.8	1.3	0.9	1.2	1.0	1.0
Adults	18 to 60 active	1.2	0.9	1.1	0.9	1.0	1.0	1.0
"	Moderately active	1.0	0.8	1.0	0.8	1.0	1.0	1.0
"	Sedentary	0.8	0.7	1.0	0.8	1.0	1.0	1.0
"	Over 60							
"	moderately active	0.9	0.7	0.9	0.7	1.0	1.0	1.0
"	Sedentary	0.8	0.6	0.9	0.7	1.0	1.0	1.0

*Average energy and nutritive requirements per person living in these dormitories as determined by this scale were as follows: Energy—3000 calories; protein—71 grams; phosphorus—1.32 grams; calcium—.75 grams; iron—.015 grams.

Table A—Frequency Distributions of Energy and the Four Nutrients in Protective Foods* Consumed per Man per Day in 47 Agricultural High Schools of Mississippi.

Energy		Protein		Calcium		Phosphorus		Iron	
Energy Groups	No. of Cases	Prot'n Groups	No. of Cases	Calcium Groups	No. of Cases	Phos. Groups	No. of Cases	Iron Groups	No. of Cases
Cal.	No.	Gms.	No.	Gms.	No.	Gms.	No.	Gms.	No.
400-600	3	10-20	2	.1-.3	2	.2-.4	2	.001-.004	6
600-800	7	20-30	7	.3-.5	10	.4-.6	8	.004-.007	9
800-1000	16	30-40	15	.5-.7	16	.6-.8	9	.007-.010	17
1000-1200	11	40-50	11	.7-.9	11	.8-1.0	13	.010-.013	10
1200-1400	6	50-60	10	.9-1.1	7	1.0-1.2	11	.013-.016	4
1400-1600	4	60-70	2	1.1-1.2	1	1.2-1.4	4	.016-.019	1

*Calculated by the long method using in most instances the table for nutritive value of foods in Sherman's "Chemistry of Food and Nutrition" [11] and Rose's "Laboratory Handbook for Dietetics" [10]. Foods used which had not had their nutritive value computed were analyzed by chemists in the Mississippi Experiment Station.

Table B—Frequently Distribution of Energy in Milk, in Butter, and in Eggs, Meat, and Fish Consumed per Man per Day in 47 Agricultural High Schools of Mississippi

Milk		Butter		Eggs, Meat, and Fish	
Energy Groups	No. of Cases	Energy Groups	No. of Cases	Energy Groups	No. of Cases
calories	number	calories	number	calories	number
None	0	None	3	None	1
Below 100	6	Below 100	4	Below 100	12
100-200	13	100-200	15	100-200	12
200-300	16	200-300	16	200-300	7
300-400	8	300-400	4	300-400	4
400-500	4	400-500	3	400-500	5
500-600	0	500-600	2	500-600	6

Table C—Frequency Distribution of Energy in Vegetables (except potatoes), in Fruit, and in Raw Fruit, Raw Vegetables, and Canned Tomatoes Consumed per Man per Day in 47 Agricultural High Schools of Mississippi.

Vegetables (except potatoes)		Fruits		Raw Fruits, Raw Vegetables, Canned Tomatoes	
Energy Groups	No. of Cases	Energy Groups	No. of Cases	Energy Groups	No. of Cases
calories	number	calories	number	calories	number
None	1	None	13	None	29
Below 50	8	Below 50	9	Below 50	12
50-100	6	50-100	14	50-100	3
100-150	11	100-150	5	100-150	2
150-200	10	150-200	3	150-200	1
200-250	5	200-250	3	200-250	0
250-300	4	250-300	0	250-300	0
300-350	2	300-350	0	300-350	0

FOOD CONSUMPTION

Do you board in the dormitory ---- Name -----

Age ----- School -----

Date -----

What did you eat yesterday at the following periods:
(Give number of servings of each food eaten).

<u>Breakfast</u>		<u>Between Breakfast and Dinner</u>		<u>Dinner</u>	
Food	Amount	Food	Amount	Food	Amount

<u>Between Dinner and Supper</u>		<u>Supper</u>	<u>Between Supper and Bedtime</u>		
Food	Amount	Food	Amount	Food	Amount

ACTIVITIES

Do you board in the dormitory_____ Name _____

Age _____ School _____

Date _____

What were you doing yesterday at the following times:

(If 2 or 3 activities are carried on in same hour, give approximate number of minutes devoted to each).

From 3 A. M. - 4 A. M. _____

4 A. M. - 5 A. M. _____

5 A. M. - 6 A. M. _____

6 A. M. - 7 A. M. _____

7 A. M. - 8 A. M. _____

8 A. M. - 9 A. M. _____

9 A. M. - 10 A. M. _____

10 A. M. - 11 A. M. _____

11 A. M. - Noon _____

Noon - 1 P. M. _____

1 P. M. - 2 P. M. _____

2 P. M. - 3 P. M. _____

3 P. M. - 4 P. M. _____

4 P. M. - 5 P. M. _____

5 P. M. - 6 P. M. _____

6 P. M. - 7 P. M. _____

7 P. M. - 8 P. M. _____

8 P. M. - 9 P. M. _____

9 P. M. - 10 P. M. _____

10 P. M. - 11 P. M. _____

11 P. M. - Midnight _____

Midnight - 3 A. M. _____

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Clothing and Houselinen Expenditures of 99 Rural Families of Mississippi During 1928-29

BY
DOROTHY DICKINS

The findings presented here are based upon the data obtained from records of money and time expenditures for clothing and houselinen kept by 99 rural families of Mississippi from October 1928 to October 1929. These data are supplemented with information in regard to the composition, income, and education of these families.

Mississippi Agricultural Experiment Station
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INTRODUCTION

An intensive study of clothing and houselinen costs among rural families of Mississippi has been made by the Division of Home Economics of the Agricultural Experiment Station. The object of this study was to determine the time and money expenditures for clothing and houselinen and for care of clothing and houselinen and some of the factors influencing these expenditures.

DESCRIPTION

COUNTIES AND COMMUNITIES

The following counties were selected for making this study: in south Mississippi—Amite, Lamar, and Simpson; in central Mississippi—Clarke, Yazoo, Leake, and Noxubee; in north Mississippi—Sunflower, Marshall, and Alcorn.

County home demonstration agents and superintendents of education suggested several typical rural communities in each of these counties. These communities were visited and a single community in each of the ten counties selected for the study.

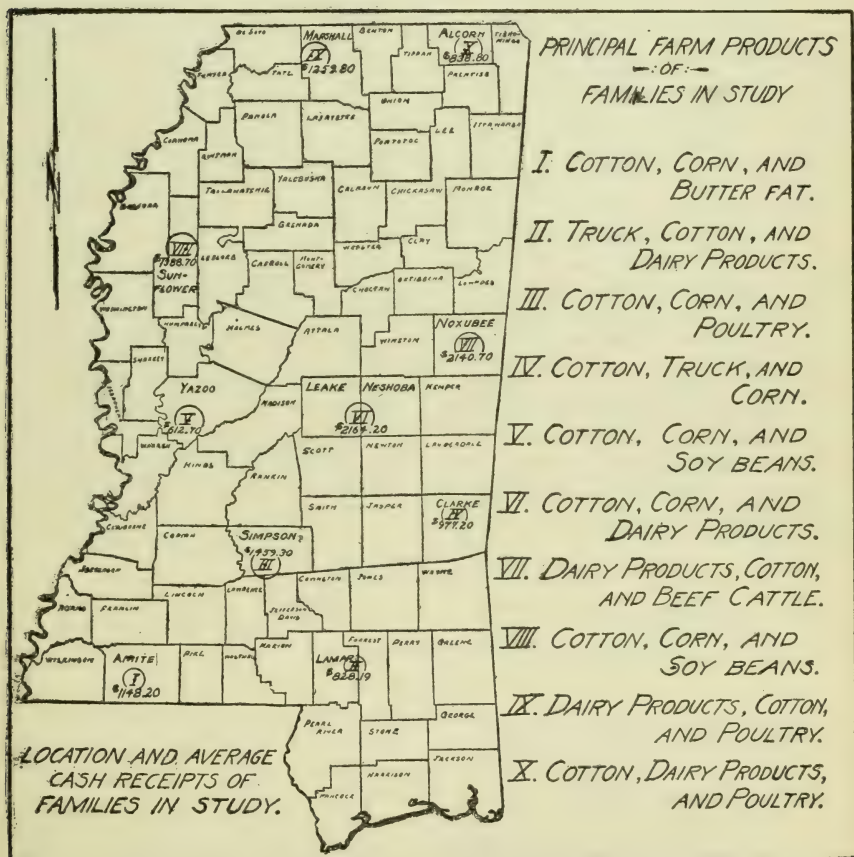


Fig. 1—Map of Mississippi showing location, principal farm products, and average cash receipts of the families enrolled in the clothing and houselinen study.

Fig. I shows the location, principal farm products, and average cash receipts of the families in each of the ten communities in which the study was conducted.

Table 1 gives the counties, type of roads, average distance from a town of 2500 inhabitants, from church, and from high school. As is shown, in three communities all families lived on graveled roads, in three communities all on dirt roads. In the other four communities, some families lived on graveled roads, some on dirt roads. Average distance from a town of 2500 inhabitants varied from 6 miles to 45 miles. Average distance from church varied from .9 mile to 5.1 miles, whereas, average distance from school varied from 1.2 miles to 15.0 miles. It is interesting to see that the distance from school was greater than the distance from church. Consolidation of schools has increased the distance of schools from home.

Table 1—Counties, type of roads, and average distance from a town of 2500 inhabitants, from church, and from high school of families in communities in which the study was made

Counties in which study was made	Type of roads	Average distance of families enrolled from:		
		Town of 2500 inhabitants	Church	High School
		miles	miles	miles
Amite	Dirt and graveled	26.0	5.1	5.7
Lamar	Graveled	6.0	.9	13.4
Simpson	Graveled and dirt	45.0	1.5	15.0
Clarke	*Dirt	15.0	1.6	11.8
Yazoo	Graveled and dirt	21.0	2.3	3.2
Leake	Dirt	17.0	3.4	2.4
Noxubee	Graveled	35.0	1.0	1.2
Sunflower	Graveled and dirt	12.0	2.1	2.0
Marshall	Graveled	35.0	1.4	6.7
Alcorn	Dirt	16.0	1.3	5.7

*Sandy clay, always passable.

The ordinary articles of clothing were, for the most part, bought in small centers near home. Articles which the family was most particular about were usually bought at a greater distance. Fifty-four of the 99 families bought some of their clothes from mail order houses. Ready-made garments were more often bought from mail order houses than were yard goods.

Eighty-four families had an automobile or truck but only 26 of the homemakers could drive it. This meant that the majority of homemakers were dependent on their husbands or children to drive them to town. In some families, especially those in which families were large and cash incomes low, the mother rarely ever left home. In this case all shopping was done by the husband or children. In communities located near town many housewives went to town once a week or even more often. In other communities many did not get to town more often than once a month or even less often.

SUPERVISORS

An intelligent, popular woman, with a means of conveyance, was employed to collect records in each community. She was carefully trained by the investigator before she began her work.

FAMILIES

After selecting the community and supervisor, the investigator and supervisor visited every home within a radius of 2 or 3 miles of the supervisor's home for the purpose of enrolling families in the study. Only families who would probably not move within a year (the length of the study) were visited; otherwise, no definite selection was made. In presenting the study to the housewife, the investigator brought out the benefits from enrolling in the study and just what was expected of those who enrolled. The housewife was given a list of clothing and houselinen on which records were desired. She was also given a short article telling of the purpose of the

study and just what was expected of each housewife who enrolled. One hundred families, ten in each of the ten communities, were enrolled in the clothing and houselinen study. One family withdrew during the first week of the study. Two families moved out of their communities after keeping records two or three months. These three families were replaced by three other families*. Another family, the fourth, moved out of the state after the study was half completed. No attempt was made to replace this fourth family. Completed records were, therefore, obtained from 99 families, one less than was planned for. The homes averaged 5.7 persons per family and 5.8 per household. Discussions in this bulletin will be limited to the family. The family includes all persons whose clothing was purchased wholly or partly from the family income.

Table 2—Ages of husbands, wives, children, and others whose clothing was purchased from the family income from October* 1928 to October of 1929

Age Groups years	Husbands number	Wives number	Children number	Others number
Under 6	----	----	71	1
6-11	----	----	124	----
12-17	----	----	122	----
18-25	2	4	36	3
26-59	82	94	----	4
60 and over	11	1	----	8
Total	95	99	353	16

*The majority of families began keeping records in October.

Table 2 gives the ages of husbands, wives, children, and others whose clothing was purchased from the family income during the year of the study. In addition there were others for whom part of the year's clothing supply was purchased from the family income including boys and girls leaving home or returning home, children born during the year, and those dying during the year.

*At the time of enrolling families, 2 or 3 extra families were noted who would take the place of families who might withdraw during the study.

Table 3*—Main source of income, net cash income, value of farm products used in home, value of house, value of gifts of clothing, total value of family living—averages per family—99 rural families of Mississippi

Counties in which study was made	Main source of income	Average net cash income	Av. val. of farm products used in home	Av. rental value of house	Av. val. of gifts of clothing	Av. total val. of family living
		dollars	dollars	dollars	dollars	dollars
Amite	8 farming 2 labor off farm	1148	382.20	73.00	22.64	1626.04
Lamar	5 farming 4 labor off farm	828.19	305.00	60.56	17.16	1210.91
Simpson	5 farming 5 labor off farm	1459.30	455.70	102.50	32.43	2040.93
Clarke	4 farming 6 labor off farm	977.20	356.80	106.50	21.72	1462.22
Yazoo	9 farming 1 labor off farm	612.70	290.60	61.50	9.63	974.43
Leake	10 farming	2164.20	365.20	139.00	8.77	2677.17
Noxubee	3 farming 7 labor off farm	2140.70	310.70	153.50	25.36	2630.26
Sunflower	10 farming	1388.70	294.60	75.00	10.77	1769.07
Marshall	7 farming 3 labor off farm	1259.80	420.50	116.00	20.91	1817.21
Alcorn	5 farming 5 labor off farm	838.80	416.20	100.00	11.18	1366.18

*Data summarized in this table were obtained by students of agricultural economics at Mississippi Agricultural and Mechanical College by personal interviews with the farm operator and in some cases other members of his family. Schedules, with a few modifications, worked out by Mr. L. E. Long, Farm Economist, were used.

Main source of income, average net cash income, average value of farm products used in the home, average rental value of the house, average value of gifts of clothing, and average total value of family living for the families in each of the ten communities studied are given in Table 3.

All families in this study lived on farms, although only two-thirds obtained the main source of their income from the farm. Average net cash income varied from \$612.70 to \$2164.20 per year.

Variation of the average value of farm products used in the home, of the average rental value of the house, and of the average value of gifts of clothing was not great in the ten communities. Size of the house, extent of modern equipment or modern improvements, and condition or state of repair were considered in valuation of houses. Ten percent of this value was taken as the rental value. [8-p. 13]. Farm products used in the home were valued at retail selling price. Gifts of clothing were valued by the housewife on the basis of what she usually paid for an article of the same type. Average total value of family living varied in the ten communities studied from \$974.43 to \$2677.17 with an average of \$1762.96.

Of the husbands of the families enrolled in the study, 1 had no schooling, 55 had been to grammar school, 25 to high school, and 14 to college. Of the wives, 46 had been to grammar school, 35 to high school, and 18 to college. Although many of these homemakers and their husbands had very little education themselves, they were all attempting to give their children at least a high school education. There were only three children of high school age from these homes, who were not in high school. Seven children from these families were boarding in agricultural high school dormitories. Ten were in college.

Ninety-five of the 99 homemakers owned a sewing machine. All machines were run by foot power. Attachments were used in about 40 percent of the homes. The gatherer was the attachment most often used. Patterns were generally used but very seldom purchased as old patterns were altered and new patterns loaned around in the community. Only one housewife owned a dress form. About 50 percent of the housewives took one or more fashion magazines. Quite a number obtained the fashion sheets distributed free at dry good stores. Some sewing was done in all but one home. Sewing was, for the most part, done by the housewife—in a few instances by older daughters. Twenty-six of the housewives sewed occasionally for persons outside the family which, for the most part, included relatives and negroes on the farm.

Electric power was available to only 3 of the 99 families. None of the families owned washing machines, only eight owned gas irons. When laundry was done at home, tubs, washboards, and sadirons (heated on the stove) were the equipment used. Eleven of the families had water piped into the house, 25 had water on the porch or right at the kitchen door, and 63 had to go out of doors to get water.

YEAR OF STUDY

The year of the study was, on the whole, a poor year as far as crop production was concerned. Crops were better in the northern than in the southern part of the state. They were especially good in the Delta for it was the year following the flood. Cost of clothing was lower than it had been since 1917. [10].

METHODS

Each supervisor visited the ten housewives enrolled in her community every two weeks throughout the year of the study. At these visits she checked over the housewife's record, which was kept on a pad furnished for the purpose, and copied this record onto the schedules provided, namely, the "Clothing and Houselinen" record and "Care of Clothing and Houselinen" record. (See Appendix.) The records were then mailed to the college, where they were checked over immediately by the investigator. If there were any omissions or discrepancies, the supervisor was notified and corrections made before the next set of records was due. A record of any changes in the composition of the family with dates of changes was sent in every four weeks. As soon as the families completed keeping records for one year, the investigator took these records, which in the meantime had been itemized for each separate person in the family and further studied for omissions and discrepancies, and checked them over with the housewife.

RESULTS

CLOTHING EXPENDITURES

Average Cost and Value of Clothing for One Year

Table 4—Average clothing expenditures per family and the proportion the clothing expenditure is of all family and farm earnings by total of family living groups.
99 farm families. Mississippi 1928-29

Groups classifying families according to total value of family living	Families in group	Average size of families	Average total value of family living	Clothing expenditures*			
				Average time expenditure for construction per family		Proportion of average total value of family living	
	number	persons	dollars	hours	minutes	dollars	percent
\$208-\$499	7	6.16	473	165	5	100.34	21.2
\$600-\$1199	31	5.80	952	170	30	154.19	16.2
\$1200-\$1799	23	5.68	1534	184	38	241.99	15.8
\$1800-\$2399	17	5.02	2106	173	2	222.23	10.6
\$2400-\$2999	9	6.05	2635	147	53	205.57	7.8
\$3000-\$6214	12	6.02	3908	225	5	292.85	7.5
All groups	99	5.71	1763	178	24	203.94	13.7

*Includes expenditures for remodeled clothing.

Table 4 gives average time expenditure for clothing and average cost of clothing per family with the proportion that this average cost is of the average value of all family living. As value of family living increased, actual cost of clothing increased but proportion of value of family living spent on clothing decreased. Time expenditure for construction of clothing also increased with increased value of family living. Table 4 shows that it took 204 dollars and 178 hours yearly to clothe about six persons. This is about 36 dollars and 31 hours per person including men, women, and children whose varying expenditures are shown in later tables. These clothing expenditures correspond rather closely with those of 86 farm families of Vermont analyzed by the Bureau of Home Economics. [5]. On the other hand, they were lower than records analyzed by the Bureau from New York, Kentucky, Ohio, Missouri, and Alabama. [4].

The above data suggest that Mississippi farm families live like farm families in Vermont. That is, they spend less for clothing than families from New York, Kentucky, Ohio, Missouri, and Alabama. However, too few records were collected to be altogether representative of the clothing habits of farm families in any of these states. The survey method was used in collecting records analyzed by the Bureau, the account method, records from Mississippi. Clothing expenditures were undoubtedly lower than usual in Mississippi for the year 1928-29 was a year of agricultural depression for most of Mississippi. Then too, clothing was cheaper in 1928-29, the year of the Mississippi study, than in 1924, the year in which the survey study was made. Clothing standards in the neighborhood in which the family resides probably have something to do with clothing expenditures. For instance, a family of five living in a very rural neighborhood with a total value of family living of \$1818.00 spent \$104.00 on clothing, whereas, another family of about the same composition and income but in another neighborhood spent \$239.19. Still another family of about the same composition and income spent \$304.90. The latter family lived in a community in which clothing standards were unusually high. According to check, the 99 families in this study dressed as well as the average family in their community. This check was made by classifying families as those better dressed than the average family in the community, the average for the community, and not as well dressed as the average.

Table 5—Average value of clothing including that made at home, ready-made, and gifts per family by value of family living, groups. 99 farm families. Mississippi 1928-29

Groups classifying		Money value				Time value			
		Expense for materials	Ready-made articles	Gifts	Total money value	Expenditure in home	Gifts	Total time value	
families according to total value of family living	Families in group	Average size of families							
	number	persons	dollars	dollars	dollars	dollars	hrs. min.	hrs. min.	hrs. min.
\$208-\$599	7	6.16	21.32	79.02	23.17	123.51	165 5	38	165 43
\$600-\$1199	31	5.80	20.94	133.25	15.60	169.79	170 30	4 17	174 47
\$1200-\$1799	23	5.68	29.45	212.54	14.25	256.24	184 38	1 24	186 2
\$1800-\$2399	17	5.02	36.70	185.53	16.96	239.19	173 2	86	176 38
\$2400-\$2999	9	6.05	22.60	182.97	31.72	237.29	147 53	5 50	153 43
\$3000-\$5214	12	6.02	40.22	252.63	12.54	305.39	225 5	52	230 37
All groups	99	5.71	28.14	175.80	17.15	221.09	178 24	3 32	181 56

As shown in Table 5, average total money value of clothes amounted to \$221.09 of which \$17.15 was in gifts, 71 cents gifts of material, \$16.44 gifts of ready-made articles. Of the total amount spent on clothing \$23.14 or about 14 percent was spent for materials, the rest for ready-made articles. Time value for construction of garments amounted to about 182 hours of which about 3.5 hours was time given by friends and relatives. In cases where it was impractical to get time given by relatives or friends, time generally spent by the housewife for a similar garment was used. Clothing hir-

ed made was included under ready-made garments. Total time value given to construction of clothing in these 99 homes, valued at 25 cents an hour, would amount to \$45.50 per family. Adding this to the total money value of clothing would give a sum of \$266.59, which is probably as close an estimate on value of clothing of these 99 families during 1928-29 as can be obtained.

Average Clothing Expenditures per Person

Table 6—Average clothing expenditure per person by sex and age groups and relative cost of each group with husbands 26-59 years as 100. 99 farm families, Mississippi 1928-29

Age group	Male				Female			
	Number of individuals	Average cost	Relative cost average for husbands 26-59 years=100		Number of individuals	Average cost	Relative cost average for husbands 26-59 years=100	
			dollars	percent			dollars	percent
All men and women								
60 years and over	14	38.36	114		6	18.18		54
Husbands and wives:								
26-59 years	82	33.69	100		94	38.21		113
18-25 years	2	29.05	86		4	77.24		229
Other men and women								
26-59 years	2	48.55	144		2	10.47		31
18-25 years	3	50.47	150		....	.....		.....
Children								
18-25 years	16	69.72	207		20	61.78		183
12-17 years	62*	42.82	127		59	59.11		175
6-11 years	62	20.94	62		62	20.77		63
Under 6 years	34	12.18	36		38	12.89		38

*An invalid not averaged in this group.

The average clothing expenditures per person, classified by sex and age groups, are given in Table 6. The relative cost for the various groups in terms of the average cost for husbands 26-59 years of age are also shown. At 18-25 years of age boys' and girls' clothing cost more than it cost at any other time; under 6 years, less than it cost at any other time. Clothing expenses for children under 6 years amounted to about one-third of that of their 26-59 year old father, for children from 6-11 years to about two-thirds of that of their 26-59 year old father, for children from 12-17 years to about one and a half times that of their 26-59 year old father, and for children from 18-25 years to about 2 times that of their 26-59 year old father. Wives 26-59 years of age spent more than husbands of the same age. Expenditures for boys and girls less than 12 years of age were about the same.

Expenditures for Different Types of Clothing

Table 7—Average clothing expenditures* per person classified by age and sex for clothing groups and percent each group is of total clothing expenditures from data obtained from 99 farm families, Mississippi 1928-29

Age group	No. of persons	Average expenditure for—									
		Headwear		Outer garments		Under garments		Footwear		Accessories	
		dol.	percent	dol.	percent	dol.	percent	dol.	percent	dol.	percent
All men 60 years and over	14	2.78	8	21.56	62	2.09	6	7.65	22	.70	2
Husbands:											
26-59 years	82	2.34	7	18.08	54	2.01	6	10.38	31	.67	2
18-25 years	2	.58	2	15.98	55	1.45	5	10.17	35	.87	3
Sons:											
18-25 years	16	3.44	5	46.06	67	3.44	5	13.06	19	2.75	4
12-17 years	62	2.08	5	25.38	61	2.08	5	10.40	25	1.66	4
6-11 years	62	1.03	5	11.93	58	1.03	5	6.17	30	.41	2
Under 6 yrs.	34	.59	5	6.44	55	1.05	9	3.51	30	.12	1
All women 60 yrs. and over	6	1.43	8	6.10	34	2.15	12	7.35	41	.90	5
Wives:											
26-59 years	94	3.42	9	18.21	48	3.42	9	12.14	32	.76	2
18-25 years	4	4.62	6	35.38	46	4.61	6	29.23	38	3.08	4
Daughters:											
18-25 years	20	3.50	6	29.20	50	3.50	6	20.43	35	1.75	3
12-17 years	59	2.94	5	27.03	46	4.11	7	23.50	40	1.17	2
6-11 years	62	.82	4	8.63	42	2.06	10	8.63	42	.41	2
Under 6 yrs.	38	.39	3	7.22	56	1.29	10	3.88	30	.13	1

*Does not include expenditures for remodeled garments as does Table 6.

The expenditures for clothing allotted to the five clothing groups (Table 7) are significant only as an indication of the clothing habits of the 99 families for the year studied.

An analysis of the distribution of these expenditures shows that the proportion spent on headwear by women and girls increases slightly with age, the greatest proportion being reached in the age group of wives 26-59 years. The proportions of clothing costs for headwear for boys did not vary with age. This is probably due to the fact that in the last few years a style of going bareheaded among boys has been in vogue.

The proportion devoted to outer garments of boys increased regularly with age. With the exception of girls under 6 years, the proportion devoted to outer garments of girls also increased regularly with age. Girls under 6 years spent more for outer garments than did girls in any other age group.

The trend of the proportion allotted to under garments shows a decrease from infancy to the ages of 18-25. The proportions then increased slightly for the older groups. Women and girls spent more for under garments than did men and boys.

Six to seventeen year old boys and girls spent a greater proportion on footwear than 18-25 year old boys and girls. This was probably due to the fact that children in the former age group attended school, those in the latter group were, for the most part, at home and did not require as much for footwear. The proportion for footwear for boys and girls under 6 years was about the same, for boys over 6 years less than for girls over 6 years. The difference in cost of hose and the fact that boys went barefooted or wore tennis shoes more frequently than girls, would probably account for this difference. Husbands 26-59 years spent about the same proportion for footwear as did wives 26-59 years of age.

The proportion spent on accessories shows an increase up to 18-25 years of age, then a slight decrease for husbands and wives 26-59 years of age.

In a study of clothing expenditures of Nebraska farm families [12] about two-thirds of the clothing costs were spent for outer garments, about one-fourth for footwear, and the rest was divided between under garments and accessories. These Mississippi farm families spent about one-half of the clothing cost for outer garments and about one-third for footwear. One would not expect Mississippi people to spend as much for outer garments as Nebraska people, for the climate of Mississippi is much milder.

A Comparison Between Garments That Are Homemade and Purchased

A comparison between new garments that are made at home and those purchased by the 99 rural families of Mississippi is presented in Table I of the Appendix. The purpose of this table is: first, to show what garments are made at home by the majority of people; and second, to show, by a comparison between the cost of the homemade and of the purchased garments the relative money costs. The list of garments presented in this table, therefore, does not include items that were practically never made at home such as, woolen coats, pants, handkerchiefs, hats, rayon bloomers, and the like.

The figures shown in Table I include the number of persons reporting an expenditure for each garment and the percent that number is of the number of persons in the sex and age group, as well as the average number of garments per person and per person with expenditure and the average cost per person, per person with expenditure, and per garment. The number of individuals in each sex and age group, and the number of families in which the persons in the sex and age group are found, are given at the top of each table. The average number of garments per person was obtained by dividing the total number of garments by the total number of persons in the sex and age group, whereas, the average number of garments per person with ex-

penditure was obtained by dividing the total number of garments by the number of persons with an expenditure for that garment. The average cost per person and per person with expenditure was obtained in a similar way. The average number of garments per person indicates the average annual replacements for the persons included in the group.

The homemade garments include the garments for which only the cost of material used in making the garments was entered. If the cost of labor was included in the cost of making a garment, that garment was considered as purchased. "H.M." refers to homemade garments and "Pur." to purchased garments. If an individual reported both homemade and purchased expenditures for the same kind of garment, that individual is included in the number of persons with expenditure for both the homemade and the purchased. A dash indicates the absence of any individual in the sex and age group reporting any expenditure for the garment.

An asterisk indicates that feed or flour sacks were used in construction of some of the garments. As seen in Table I, a number of under garments were made with this material. Very few outer garments, with the exception of aprons, were made with sacks. Farm families usually have a large number of these sacks. When ripped, bleached, and washed they make very substantial material. Some of the sacks thus treated look very much like domestic, others have the texture of beach cloth.

An analysis of the average number of homemade and purchased garments per person for each sex and age group indicates that for most of the garments included in the table daughters, wives, and sons under 6 years have a larger number of homemade than of purchased garments. Boys over 6 years and husbands have a larger number of purchased garments.

If the number of each garment is analyzed as to whether more are made at home or purchased we find aprons, cotton dresses, and wool dresses* homemade in practically every age group of the girls and women. Silk dresses**, on the other hand, were usually purchased by daughters 12 years of age and over, and by wives. The number reporting cotton coats, skirts, and blouses is too small to furnish sufficient figures. Most of the items of under garments listed in the table for wives and daughters, with the exception of brassieres, are homemade.

There are few garments homemade for sons over six years of age and for husbands. Nightshirts and pajamas were usually homemade, shirts and B. V. Ds purchased. Younger boys had more homemade garments than older boys.

In most cases the homemade garments were cheaper than the purchased garments. The majority of housewives in this study stated that they could make a better garment for less money than they could buy one. Just how much more durable the homemade garments are, is, of course, impossible to say in a study of this nature. Whether it pays to sew would depend on cash available and opportunities for profitably using the time for some other purpose. In this study for instance, if the homemade and purchased cotton dresses of the 26-59 year old wife were of the same durability and style, the housewife saved only 47 cents by making her cotton dresses. That is, she earned 47 cents for about six hours expenditure. If this is true, she should have bought her cotton dresses for her time is surely worth more than 8 cents an hour. On the other hand, if the \$1.12 homemade dress has the style and durability of a \$3.95 purchased dress, then she has saved \$2.83 or earned 43 cents an hour.

*Including dresses of mixed wool and cotton.

**Including rayon dresses. Silk and rayon dresses were grouped under one heading as it was often difficult for the supervisor to distinguish between silk and rayon.

Home sewing, however, cannot be viewed entirely from the economic standpoint. Many homemakers sew because they enjoy it—because they get a personal satisfaction from creating a garment. Some are doubtless better pleased with garments they can make than with those they can buy.

Kind, Amount, and Cost of Remodeled Clothing per Family

Table 8—Average kind, amount and cost of remodeled clothes per family by total value of family living groups. 99 farm families. Mississippi 1928-29

Groups classifying families according to total value of family living	Families in group	Average size of families	Kind and number of garments per family								Exp. for remodeled clothing per family	
			Coats overcoats		Other garments		Tot. No.	No.	No.	No.	dol.	hrs.
			Dresses	jackets	Suits	Pants						
	No.	persons	No.	No.	No.	No.	No.	No.	No.	No.		
\$208-\$599	7	6.16	5.2	.8	.2	..	.2	1.4	7.8	1.05	44	
\$600-\$1199	31	5.80	4.4	.8	.2	.2	.8	.6	7.0	4.05	41	
\$1200-\$1799	23	5.68	2.2	.8	.2	.4	.2	1.0	4.8	2.85	30	
\$1800-\$2399	17	5.02	2.0	.4	.2	..	.2	2.2	5.0	3.90	11	
\$2400-\$2999	9	6.05	2.6	.8	.8	.2	..	.6	5.0	2.65	12	
\$3000-\$5214	12	6.02	3.4	.8	..	.2	.2	.8	5.4	2.95	12	
All groups	99	5.71	3.2	.7	.2	.2	.4	1.0	5.7	3.27	27	

As shown in Table 8, there was very little difference in expenditures for remodeled clothing in the six family living groups. The poorer groups, however, remodeled a few more garments and spent a little more time in this work than did the other groups. Dresses were remodeled more often than were any other garment.

Seasonal Variation in Clothing Expenditures

Table 9—Seasonal variation in expenditures for clothing. 99 farm families. Mississippi 1928-29

Item	Season			
	Fall	Winter	Spring	Summer
	percent	percent	percent	percent
Distribution of money expenditures	36	21	24	19
Distribution of time expenditures	30	17	29	24

Both money and time expenditures for clothing were greater in the fall and spring than in winter and summer. Over one-third of the year's clothing was bought in the fall. This is probably due to two facts. First, crops are sold in the fall and more cash is available at that time of the year, and, second, winter garments, or the more expensive garments, are generally purchased then.

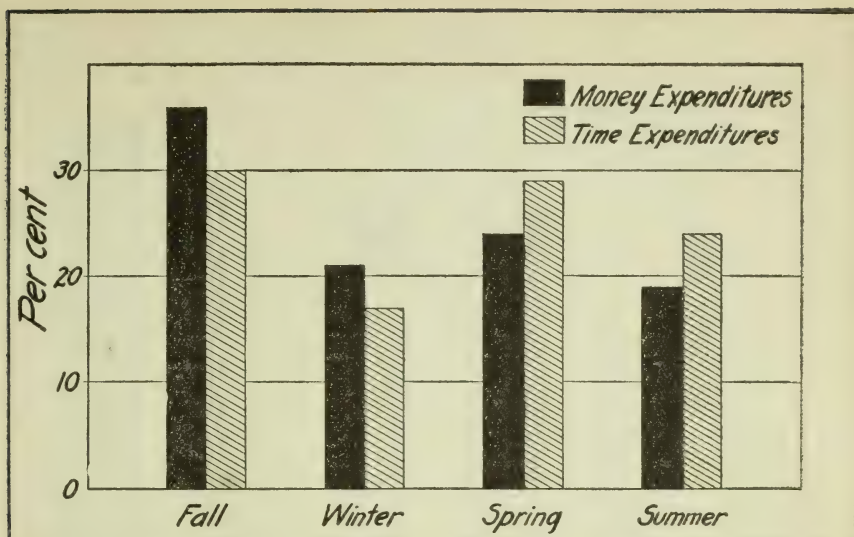


Fig. 11—Average percentage distribution of money and time expenditures for clothing of 99 rural families of Mississippi during four seasons, October 1928 to October 1929.

Factors Influencing Clothing Expenditures

In Table 6 it was shown that clothing expenditures varied with age and sex, that is, a girl 18-25 years of age spent an average of \$61.78 on clothing per year, whereas, her brother under 6 years spent only \$12.18. This difference between members of the family group must be considered in determining the relation of a given income to families of different age and sex composition. Dr. May Louise Cowles [6] has worked out the following clothing scale based on the standard of living of 2886 white farm families of selected localities in eleven states [9]:

Scale of clothing expenditures for members of 2886 farm families with husband's expenditure as a base.

Males	Score	Females	Score
Husband	1.0	Wife	1.0
Son over 24 years	1.3	Daughter over 24 years	1.4
Son, 19 to 24 years	1.5	Daughter, 19 to 24 years	1.7
Son, 15 to 18 years	1.2	Daughter, 15 to 18 years	1.4
Son, 12 to 14 years	.7	Daughter, 12 to 14 years	.9
Son, 6 to 11 years	.5	Daughter, 6 to 11 years	.6
Son, 1 to 5 years	.3	Daughter, 1 to 5 years	.3
Son under 1 year	.2	Daughter, under 1 year	.2

The average size of families figured on this scale for the six values of living groups is as follows: \$208-\$599 value of living group 4.63 adult male units, \$600-\$1199 value of living group 4.87 adult male units, \$1200-\$1799 value of living group 5.07 adult male units, \$1800-\$2399 value of living group 4.51 adult male units, \$2400-\$2999 value of living group 4.86 adult male units, and \$3000-\$5214 value of living group 4.93 adult male units. Thus figured, there was a variation of only .56 adult male unit in the six value of family living groups studied. The lowest value of family living group had, however, the greatest number of girls 12 years and over (See Table III in Appendix) which, at least, in part, accounts for the large proportion of the family living from this group spent for clothing.

Fig. III shows the average expenditure for clothing per adult male unit per family in the six family living groups studied. Nearly three times more per adult male unit was spent in the \$3000-\$5214 value of living group than

in the \$208-\$599 value of living group. Clothing expenditures, with the exception of the \$2400-\$2999 value of living group, increased with increased value of living. The number of cases in this group was doubtless too few to be representative.



Fig. III—Relation of money expenditures for clothing per adult male unit per family to value of family living.

Table 10—Relation of average clothing expenditures of husbands and wives to size of family. 99 farm families, Mississippi 1928-29

Persons in family	Families in group	Average total value of family living	Average clothing expenditures			
			For husbands	For wives	For children and others	Total
number	number	dollars	dollars	dollars	dollars	dollars
2 and under 3	5	2110	42.59	54.14	.....	96.73
3 and under 4	7	2117	49.11	75.69	44.55	169.35
4 and under 5	21	1563	41.65	41.29	101.08	184.02
5 and under 6	19	1554	37.44	38.97	106.16	182.57
6 and under 7	12	1652	28.50	36.94	146.10	211.54
7 and under 8	11	1966	28.43	38.68	174.12	241.23
8 and under 9	14	2093	28.01	31.56	187.46	247.03
9 and under 10	7	1632	26.63	22.54	234.41	283.58
10 and under 11	3	1779	21.72	15.23	147.13	184.08

With an increase in size of family, husbands' and wives' clothing expenditures show (Table 10) a decrease and childrens' an increase. The decrease is greater in wives' than husbands' clothes. Wives, in very large families, do not leave home as often as do other wives and consequently do not need as many clothes. The larger families spend more on clothing than do the smaller families.

Table 11—Relation of average clothing expenditure of boys to age and position in family. 99 farm families, Mississippi 1928-29

Age groups	Average clothing expenditures of:															
	1st Boy		2nd Boy		3rd Boy		4th Boy		5th Boy		6th Boy		7th Boy		8th Boy	
	Cases	Exp.	Cases	Exp.	Cases	Exp.	Cases	Exp.	Cases	Exp.	Cases	Exp.	Cases	Exp.	Cases	Exp.
Under 6 yrs.	No.	Dol.	No.	Dol.	No.	Dol.	No.	Dol.	No.	Dol.	No.	Dol.	No.	Dol.	No.	Dol.
6-11 yrs.	2	13.81	4	19.04	6	13.19	6	12.96	4	9.81	7	10.19	4	8.58	1	8.63
12-17 yrs.	12	26.69	15	22.85	7	21.16	10	22.42	9	16.13	7	12.91	2	13.66	..	.....
18-25 yrs.	22	51.44	20	43.69	12	35.53	5	26.49	2	29.51	1	31.62	..	.....	..	.....
18-25 yrs.	11	76.26	5	55.34	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

Table 12—Relation of average clothing expenditure of girls to age and position in family.
99 farm families, Mississippi 1928-29

Age groups	Average clothing expenditures of:																							
	1st Girl		2nd Girl		3rd Girl		4th Girl		5th Girl		6th Girl		7th Girl		8th Girl									
	Cases	Exp.	Cases	Exp.	Cases	Exp.	Cases	Exp.	Cases	Exp.	Cases	Exp.	Cases	Exp.	Cases	Exp.	Cases	Exp.	Cases	Exp.	Cases	Exp.	Cases	Exp.
Under 6 yrs.	6	18.65	6	11.11	8	15.86	5	13.48	4	10.16	5	9.14	2	7.98	2	7.34								
6-11 yrs.	26	31.89	8	24.65	12	19.36	13	16.96	15	16.19	3	18.82	1	19.72										
12-17 yrs.	15	78.99	20	60.22	17	53.41	7	27.17																
18-25 yrs.	24	64.06	5	51.49	1	81.31																		

Tables 11 and 12 show that clothing expenditures are greater generally speaking for the first boy and girl of a certain age than for the fourth or fifth boy and girl of the same age. In the majority of groups, however, there are entirely too few cases to draw any definite conclusions. In the 12-17 year old group, however, in which the number of cases seems to be concentrated in a few groups, the first boy spent \$51.44, the second, \$43.69 and the third \$35.53 for clothing, whereas, the first girl spent \$78.99, the second \$60.22, and the third, \$53.41. The second and third boy and girl undoubtedly received some passed down clothing. Records were not kept of clothing which was passed down from one child to the next in which no expenditures of money or time were involved. However, inquiries revealed passing down clothing in families of more than one child a common practice.

Table 13—Relation of average clothing expenditures to distance from a town of 2500 inhabitants and graveled roads to this town. 99 farm families, Mississippi 1928-29

Distance from town of 2500 inhabitants	Families in group	Av. size of families	Av. total value of family living	Av. cost of clothing per family	Roads to this town	Families in this group	Av. size of families	Av. total value of family living	Av. cost of clothing per family
	number	number	dollars	dollars		number	No. persons	dollars	dollars
Less than 5 miles	25	5.44	1603	224.44	Graveled	49	5.75	1900	204.07
5-10 miles	44	6.04	1617	188.36	Graveled part way	40	5.69	1367	189.48
Over 10 miles	30	5.44	2110	209.71	Not graveled	10	5.59	2677	261.10

There seems to be very little relation in distance from a shopping center and in type of roads and clothing expenditures. This may have been due to the fact that there was one rather up-to-date community included in this study located on dirt roads and over ten miles from a town of 2500 inhabitants. The families in this community were above the average.

Table 14—Relation of average clothing expenditure to distance from church and distance from high school. 99 farm families, Mississippi 1928-29

Distance from church	Families in group	Av. size of families	Av. total value of family living	Av. cost of clothing per family	Distance from high school	Families in group	Av. size of families	Av. total value of family living	Av. cost of clothing per family
	No.	No. persons	dollars	dollars		No.	No. persons	dollars	dollars
Less than 1 mile	17	6.32	1887	250.29	Less than 5 miles	42	5.83	2009	219.64
1-5 miles	70	5.44	1730	194.46	5-10 miles	33	5.56	1605	182.77
5 miles and over	12	6.42	1778	193.58	10 miles and over	24	5.70	1549	205.57

There seems (Table 14) to be some relation in distance from church and clothing expenditure. That is, families living nearer to church, one of the rural social centers, spend more on clothing. On the other hand, there seems to be little relation in distance from high school and clothing expenditure. Consolidation of schools, especially high schools, has taken place rapidly in Mississippi. This has often moved the high school quite a distance from the community. One would probably find the social center in the old school district or in the grammar school district. Grammar schools are more numerous and are consequently nearer home.

Table 15—Relation of average clothing expenditure to education of farm operator.
99 farm families. Mississippi 1928-29

Extent of education of operator*	Families in group	Av. size of families	Av. total value of family living	Av. cost of clothing per family
	No.	No. persons	dollars	dollars
Attended grammar school	55	5.81	1589	196.77
Attended high school	25	5.66	1766	290.93
Attended college	14	5.44	2592	234.75

*One operator, no schooling.

Table 16—Relation of average clothing expenditure to education of homemaker
99 farm families. Mississippi 1928-29

Extent of education of homemaker	Families in group	Average size of families	Average total value of family living	Average cost of clothing per family
	number	number persons	dollars	dollars
Attended grammar school	46	5.78	1381	178.30
Attended high school	35	5.73	1890	215.23
Attended college	18	5.50	2492	247.52

As shown in Tables 15 and 16, clothing expenditures increased with increased education of both husband and wife, although to a greater extent with that of the wife. However, this increase is doubtless only in very small part due to increased education and in very large part due to the fact that the total value of family living is greater in the more educated families. It has already been shown that there is a relation between value of family living and clothing expenditures.

HOUSELINEN EXPENDITURES

Average Cost and Value of Houselinen per Family for One Year

Table 17—Average houselinen expenditures per family and the proportion the houselinen expenditure is of all family and farm earnings by total value of family living groups.
99 farm families. Mississippi 1928-29

Groups classifying families according to total value of family living	Families in group	Average size of families	Average total value of family living	Houselinen expenditures*			
				Average time expenditure for construction per family		Proportion of average total value of family living	
	No.	No. persons	dollars	hrs.	min.	dollars	percent
\$208-\$599	7	6.16	473	46	0	6.28	1.3
\$600-\$1199	31	5.80	952	40	5	7.16	.8
\$1200-\$1799	23	5.68	1534	55	24	10.86	.7
\$1800-\$2399	17	5.02	2106	44	30	9.44	.4
\$2400-\$2999	9	6.05	2635	33	48	6.61	.3
\$3000-\$5214	12	6.02	3908	60	20	14.54	.4
All groups	99	5.71	1763	46	42	9.19	.6

*Including remodeled houselinen.

Table 17 gives average time expenditure for houselinen and average cost of houselinen per family with proportion that this average cost is of the average value of all family living. Value of houselinen increased somewhat irregularly with increased value of family living. Proportion of average total value of family living spent on houselinen decreased as value of family living increased. Time expenditure for the various groups varied irregularly from 33 hours and 48 minutes to 60 hours and 20 minutes with an average of about 46 hours and 42 minutes per family per year. Under houselinen* was included all textiles used in the home, such as bath mats, bath rags, bed spreads, blankets, chair covers, couch covers, curtains, luncheon sets, mattress pads, napkins, pillow cases (bed or sofa), quilts, rag rugs, scarfs, sheets, silence cloths, and towels.

*More correctly termed household textiles.

Table 18—Average value of houselinen including that made at home, ready-made, and gifts per family by value of family living groups. 99 farm families. Mississippi 1928-29

Groups classifying families according to total value of family living	Families in group	Average size of families	Money value			Time value					
			Expense for material	Ready-made articles	Gifts	Total money value	Expenditure in home		Gifts	Total time value	
							hrs.	min.		hrs.	min.
\$208-\$599	7	6.16	4.27	2.01	0	6.28	46	0	..	46	0
\$600-\$1199	31	5.80	4.08	3.08	.63	7.79	10	5	..	30	40
\$1200-\$1799	23	5.68	6.96	3.90	1.15	12.01	55	24	..	42	56
\$1800-\$2399	17	5.02	5.58	3.86	1.61	11.05	44	30	..	44	30
\$2400-\$2999	9	6.05	3.75	2.86	.56	7.17	33	48	..	33	48
\$3000-\$5215	12	6.02	10.17	4.87	3.25	17.79	60	20	..	60	20
All groups	99	5.71	5.73	3.47	1.19	10.39	46	42	..	19	47

As shown in Table 18, average money value of houselinen amounted to \$10.39, of which \$1.19 was in gifts. Of the total amount spent on houselinen \$5.73 or 55 percent was spent for materials, the rest for ready-made articles. Time for construction of articles amounted to about 47 hours. If expenditures for materials are in any way an index to amount of home sewing done, houselinen is more often made at home than clothing; for only 14 percent of the clothing expenditures went for materials.

A Comparison Between Articles That Are Homemade And Purchased

A comparison between new articles that are made at home and those purchased is presented in Table II of the Appendix. The list of articles given does not include articles that were never or practically never made at home such as blankets, silence cloths, bed spreads, and the like.

The figures shown in Table II include the number of families reporting an expenditure for each article and the percent that number is of the number of families in the family living group, as well as the average number of articles per family and per family with expenditure and the average cost per family, per family with expenditure, and per article. The number of families in each family living group is given at the top of each table.

The averages were obtained in the same manner as averages for clothing in Table I of the Appendix. The homemade articles include the articles for which only the cost of material used in making the article was entered. If the cost of labor was included in the cost of making a garment that garment was considered as purchased.

An asterisk indicates that feed or flour sacks, old clothes, or scraps were used in construction of the article. Quilts and rugs were largely made from scraps of materials, old clothes, and dyed sacks. The majority of the homemade towels were made from sacks. Sacks were used in construction of practically every other article of houselinen listed by one or more families. They were, however, not used in the higher family-living groups to as great an extent as the lower family living groups.

An analysis of the average number of homemade and purchased articles per family indicates that for most of the articles included in the table, there is a larger number of homemade than of purchased articles. The \$208-\$599 family living group had the least number of homemade articles per family, the \$1200-\$1799 and \$3000-\$5214 living groups the greatest number.

Pillow cases, quilts, scarfs, sheets, and towels appeared on records of every family living group. The majority of the first four articles were made at home. About as many towels were purchased as were homemade. Only 43 tablecloths and 65 napkins were added to the houselinen supply of the 99 families during the year of the study. The \$3000-\$5214 family living group added the greatest number of napkins, the \$1200-\$1799 group the greatest number of tablecloths. Several families in each group used oil-cloth tablecloths.

In the majority of cases the homemade articles were cheaper than the purchased articles. This was especially so with articles like towels in which a large number of sacks were used in construction. However, there were quite a number of instances in which the homemade article was the more expensive. No attempt has been made in this study to answer just why the housewife makes so much of her houselinen and why she even sometimes spends more on that made at home.

Kind, Quantity, and Cost of Remodeled Houselinen Per Family

Table 19—Average kind, number, and cost of remodeled houselinen per family by total value of family living groups. 99 farm families. Mississippi 1928-29

Groups classifying families according to total value of family living	Families in group		Kind and number* of articles per family			Expenditures for remodeled houselinen per family		
			Quilts	Pillow cases	Total number	Av. money expenditures	Av. time expenditures	
	No.	No. persons					hrs.	min.
\$208-\$599	7	6.16	1.0	.1	1.1	.96	11	42
\$600-\$1199	31	5.80	.7	.1	.8	.82	10	55
\$1200-\$1799	23	5.68	.7	0	.7	1.01	10	45
\$1800-\$2399	17	5.02	.3	0	.3	.34	3	55
\$2400-\$2999	9	6.05	.1	0	.1	.10	1	44
\$3000-\$5214	12	6.02	.2	0	.2	.18	3	30
All groups	99	5.71	.5	..	.5	.65	8	0

*To nearest tenth.

As shown in Table 19, quilts were the principal article remodeled. More were remodeled in the lower family living groups than in the higher family living groups.

Seasonal Variation in Houselinen Expenditures

Table 20—Seasonal variations in expenditures for houselinen. 99 farm families. Mississippi 1928-29

	Season			
	Fall	Winter	Spring	Summer
	percent	percent	percent	percent
Distribution of money expenditures	31	35	14	20
Distribution of time expenditures	27	33	18	22

Both money and time expenditures were greater in the fall and winter

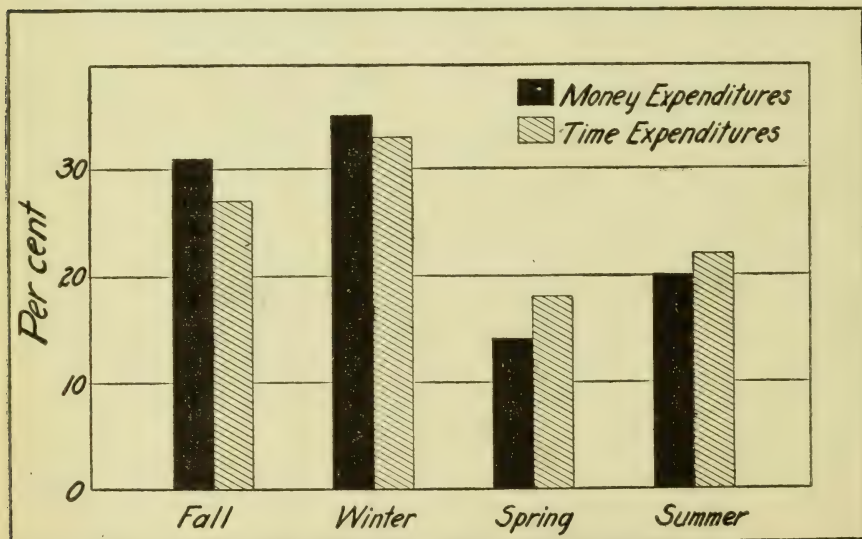


Fig. IV—Average percentage distribution of money and time expenditures for houselinen of 99 rural families of Mississippi during four seasons October 1928-Oct. 1929.

than in any other season. This is probably due to the fact that the housewife has some available leisure during the long fall and winter nights to quilt, embroidery, and the like.

Factors Influencing Houselinen Expenditures

From a study of Table 17, there seems to be a tendency for houselinen expenditures to increase with increased value of family living, although this increase is not altogether regular. How can one explain the fact that several families used oilcloth tablecloths who could have afforded cotton damask? How can one explain the fact that one family with a total value of family living of \$600-\$1199 used napkins at every meal while a neighbor with a value of family living of \$2400-\$2999 used them when there was company. Rearing and education of the housewife and what is done in the neighborhood are doubtless factors. Education of operator and homemaker is the only one of these factors, however, for which data were secured. This relation is shown in Tables 21 and 22.

Table 21—Relation of average houselinen expenditure to education of operator.
99 farm families. Mississippi 1928-29

Extent of education of operator*	Families in group	Average size of families	Average total value of family living	Average cost of houselinen per family
	number	No. persons	dollars	dollars
Attended grammar school	55	5.81	1589	9.17
Attended high school	25	5.66	1766	9.46
Attended college	14	5.44	2592	9.87

*One operator, no schooling.

Table 22—Relation of average houselinen expenditure to education of homemaker.
99 farm families. Mississippi 1928-29

Extent of education of homemaker	Families in group	Average size of families	Average total value of family living	Average cost of houselinen per family
	number	No. persons	dollars	dollars
Attended grammar school	46	5.78	1381	7.26
Attended high school	35	5.73	1890	10.78
Attended college	18	5.50	2492	11.04

Houselinen expenditures remain about the same for all education groups of operators but increase with increased education of the homemaker. From this it would seem that the homemaker is the one who has most to do with setting houselinen standards for the family and that education is one of the factors that helps set standards.

There does not seem to be any relation in houselinen expenditures and size of family. Families of two members and under three spent an average of \$10.68 per year on houselinen, families of four members and under five spent an average of \$7.59 per year on houselinen, families of six members and under seven spent an average of \$10.61 per year on houselinen, families of eight members and under nine spent an average of \$9.58 per year on houselinen, and families of ten members and under eleven spent an average of \$6.03 per year on houselinen.

MISCELLANEOUS EXPENDITURES

The value of articles of houselinen and clothing was obtained by adding the cost of all items going into the construction of the article. The housewife, however, bought a few items not purchased for any special article, that is, for general household sewing, such as thread, darning cotton, tape, buttons, and the like. These items were included under miscellaneous expenditures and are shown in Table 23. A record of equipment bought for construction and care of clothing and houselinen, such as machines, tubs, irons, and the like was not kept.

Table 23—Average miscellaneous expenditures for clothing and houselinen per family by total value of family living groups. 99 farm families. Mississippi 1928-29

Groups classifying families according to total value of family living	Families in group	Average size of families	Average total value of family living	Average miscellaneous expenditure for clothing and houselinen
	number	number persons	dollars	dollars
\$208-\$599	7	6.16	473	1.21
\$600-\$1199	31	5.80	952	1.29
\$1200-\$1799	23	5.68	1534	1.22
\$1800-\$2399	17	5.02	2106	1.44
\$2400-\$2999	9	6.05	2635	.88
\$3000-\$5214	12	6.02	3908	1.49
All groups	99	5.71	1763	1.28

Miscellaneous expenditures for clothing and houselinen were not great, nor was variation in the different family living groups great. The \$2400-\$2999 group spent the least. This group also spent the least on clothing per family. As has been mentioned, this group doubtless contained too few cases to be representative.

CARE OF CLOTHING AND HOUSELINEN

Laundering:

Table 24—Average weekly expenditure for laundering per family by value of family living groups. 99 farm families. Mississippi 1928-29

Groups classifying families according to tot. val. of family living	Families in group	Average size of families	Av. exp. laundering per family per week			
			Time expenditure		Money Expenditure	
					For laundry	For laundry sup.
	number	No. persons	hrs.	min.	dollars	dollars
\$208-\$599	7	6.16	7	7	.03	.12
\$600-\$1199	31	5.80	6	52	.15	.10
\$1200-\$1799	23	5.68	6	38	.24	.12
\$1800-\$2399	17	5.02	4	38	.57	.11
\$2400-\$2999	9	6.02	5	25	.44	.13
\$3000-\$5214	12	6.02	4	28	.81	.13
All groups	99	5.71	6	1	.34	.11

As shown in Table 24, an average of 6 hours and 1 minute per week was spent for laundry work, 34 cents for laundry hired done and 11 cents for soap, starch, bluing, or laundry supplies. The value of water and fuel used in laundering was not obtained from these families. As value of family living increased, time expenditures for laundry decreased and money expenditures increased. Laundry supplies were about the same for all groups. Four families made most of their laundry soap at home. Soap was purchased in the other homes. Gas irons were the only labor saving laundry equipment owned. They were owned by only 8 families and, even in these 8 homes, were not always used. The lack of laundry labor saving equipment is, in part, due to the fact that usually as soon as the family can afford it the housewife turns a part or all of the family wash over to a negro woman who does it very cheaply. For instance, the Smiths, a family of eight people, had most of their laundry work done for \$1.25 a week. It is, of course, not always possible to get laundry done so cheaply. In some sections of the state, there are few negroes. In such locations, the housewives who can afford and would hire most of their laundry work done cannot get anyone to do it. Lack of available electrical power and the feeling that surely they will get help at some later date results in a lack of laundry labor saving equipment when it is woefully needed. An average of 6 hours and 2 minutes per week was spent for laundry in the fall, 5 hours and 32 minutes in the winter, 6 hours in the spring, and 6 hours and 30 minutes in the summer. Several of the housewives who ordinarily did their washing were sick during the winter

of the study and their washing was hired done. Then, too, washerwomen are more available in the winter after one cotton crop is picked and before the next is planted. The fact that garments are more readily soiled in summer time explains the greater time expenditure during that season.

Factors That Influence Expenditures for Laundry—That there is a relation between value of family living and expenditures for laundering is clearly brought out in Table 24. Fig. V shows the average time expenditure

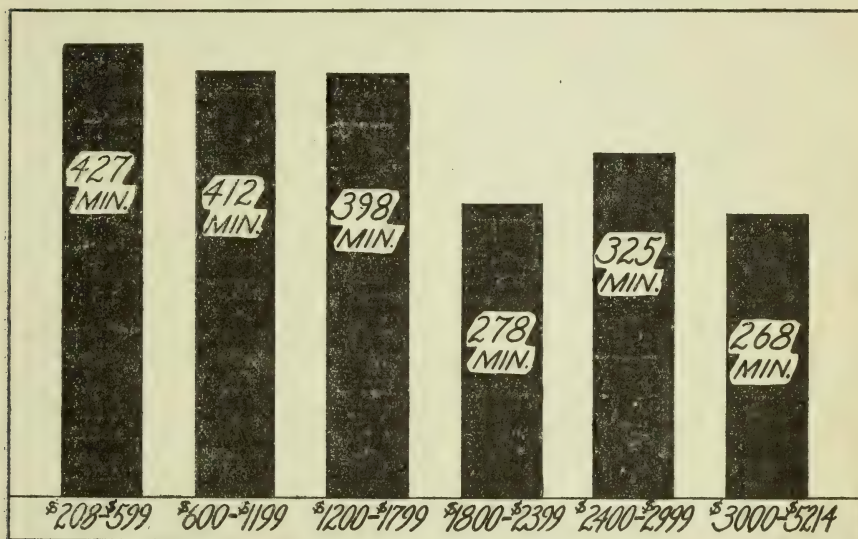


Fig. V—Relation of time expenditures for laundering per family per week to value of family living.

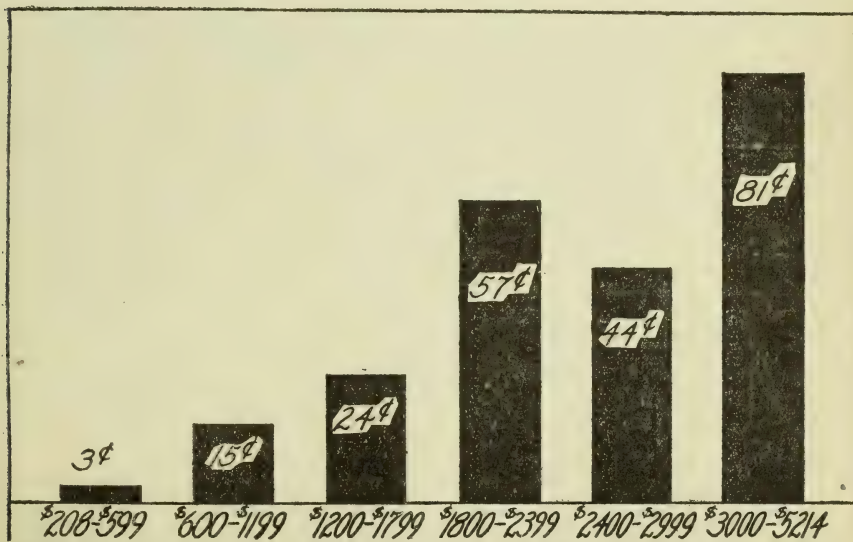


Fig. VI—Relation of money expenditures for laundry per family per week to value of family living.

for laundering per family per week in the six family living groups studied. Fig. VI shows the relation of money expenditures for laundering per family per week to value of family living.

Table 25—Relation of average weekly expenditures for laundry to ages of children* in the family. 99 farm families. Mississippi 1928-29

Ages of children in family	Number of families	Av. number of children in family	Average expenditures in laundering per family per week			
			Time expenditures		Money expenditure	
			hrs.	min.	For laundry dollars	For supplies dollars
Under 6 years only	6	1.5	4	27	.35	.09
6-11 years only	4	1.5	3	12	.49	.09
12-17 years only	8	2.1	5	34	.12	.11
18-25 years only	3	1.7	4	47	.22	.09
Under 6 years and 6-11 years	15	3.3	4	59	.39	.11
Under 6 years and 12-17 years						
6-11 years and 12-17 years	9	3.1	5	50	.31	.10
6-11 years and 18-25 years	5	3.6	5	31	.37	.11
12-17 years and 18-25 years	4	2.5	4	26	.37	.08
Under 6 yrs. 6-11 yrs. & 12-17 yrs.	19	5.3	5	44	.59	.14
6-11 yrs. 12-17 yrs. & 18-25 yrs.	12	5.0	8	13	.14	.13
In all age groups	8	6.9	11	33	.18	.15

*Children at home for a part of the year averaged in.

Table 25 shows that time expenditures for laundry and expenditures for laundry supplies are influenced by composition of families. Composition of family does not seem to affect money expenditures for laundry. It is impossible to bring out the relation of laundry expenditures to labor saving devices, for, as previously mentioned, gas irons were the only labor saving device owned and they were owned by only a few families. No saving in time in these few families was noted. Families doing all their laundry work whose water supply was in their house or at the kitchen door saved about 30 minutes a week in time expenditures for laundry over families whose water supply was out of doors.

Dry Cleaning:

Table 26—Average yearly expenditure for dry cleaning per family by value of family living groups. 99 farm families. Mississippi 1928-29

Groups classifying families according to total value of family living	Families in group	Average size families	Av. expenditures for dry cleaning per family			
			Time expenditures		Money expenditures	
			hrs.	min.	For dry cleaning dollars	For supplies dollars
\$208-\$599	7	6.16	..	46	.44	.03
\$600-\$1199	31	5.80	6	0	1.64	.08
\$1200-\$1799	23	5.68	2	18	4.44	.05
\$1800-\$2399	17	5.02	4	48	4.01	.06
\$2400-\$2999	9	6.05	6	18	3.33	.19
\$3000-\$5214	12	6.02	2	50	4.50	.05
All groups	99	5.71	4	12	3.11	.07

One is not surprised at the small expenditures for dry cleaning of the 99 rural families studied as shown in Table 26, when one considers that cotton garments were the kind mostly used. Money expenditures for dry cleaning increased somewhat with increased value of family living, whereas, there seemed to be no relation in time expenditures and value of family living.

Dyeing:

* Dyeing was done in only 10 of the 99 homes during the year of the study. Three of these homes were in the \$600-\$1199 value of family living group, 4 in the \$1200-\$1799 value of family living group, 2 in the \$1800-\$2399 value of living group, and 1 in the \$2400-\$2999 value of living group. Silk dresses were more frequently dyed than any other type of article. A

total of \$1.50 in money and 27 hours in time was spent in dyeing textile articles in these ten homes.

Mending:

Table 27—Average weekly expenditure for mending per family by value of family living groups. 99 farm families. Mississippi 1928-29

Groups classifying families according to total value of family living	Families in group number	Average size of families No. persons	Average time expenditures for mending per family	
			hours	minutes
\$208-\$599	7	6.16	1	28
\$600-\$1199	31	5.80	1	52
\$1200-\$1799	23	5.68	1	33
\$1800-\$2399	17	5.02	1	33
\$2400-\$2999	9	6.05	1	34
\$3000-\$5214	12	6.02	1	49
All groups	99	5.71	1	42

As shown in Table 27, there was not much variation in time expenditures in mending in the six value of family living groups studied, the greatest expenditure, 1 hour and 52 minutes per week, being in the \$600-\$1199 group, the least, 1 hour and 33 minutes per week in the \$1800-\$2399 group. The homemaker received less help from her family in mending than she did in laundering and dry cleaning. In only three cases was mending hired done, two for pants and one for silk hose. An average of 1 hour and 46 minutes per week was spent in mending in the fall, 1 hour and 46 minutes in the winter, 1 hour and 42 minutes in the spring, and 1 hour and 34 minutes in the summer. It seems that mending is somewhat more a fall and winter activity.

Table 28—Relation of average weekly expenditures for mending to ages of children* in the family. 99 farm families. Mississippi 1928-29

Ages of children in family	Number of families	Average number of children in family	Average time expenditures in mending per family per week	
			hours	minutes
Under 6 years only	6	1.5	1	0
6-11 years only	4	1.5	1	12
12-17 years only	8	2.1	1	26
18-25 years only	3	1.7	7	4
Under 6 years and 6-11 years	15	3.3	1	34
Under 6 years and 12-17 years	9	3.1	1	44
6-11 years and 12-17 years	5	3.6	1	42
6-11 years and 18-25 years	4	2.5	1	24
Under 6 yrs., 6-11 yrs., & 12-17 yrs.	19	5.3	2	1
6-11 yrs., 12-17 yrs. & 18-25 yrs.	12	5.0	2	5
In all age groups	8	6.9	2	37

*Children at home for a part of the year averaged in.

Table 28 shows that there is a definite relation between mending expenditures and composition of family. That is, in larger families more time is spent in mending than in smaller families. There seems to be a closer relation in composition of family and mending expenditures than in value of family living and mending expenditures.

Repair and Care of Shoes

Table 29—Average yearly expenditure for repair and care of shoes per family by value of family living groups. 99 farm families. Mississippi 1928-29

Groups classifying families according to total value of family living	Families in group number	Average size of families No. persons	Average expenditure per family for:			
			Repair of shoes dollars	Shoe shines dollars	Shoe polish dollars	Total dollars
\$208-\$599	7	6.16	1.25	.04	.40	1.69
\$600-\$1199	31	5.80	1.49	.16	.69	2.34
\$1200-\$1799	23	5.68	2.16	.43	.56	3.15
\$1800-\$2399	17	5.02	3.55	.49	1.09	5.13
\$2400-\$2999	9	6.05	2.53	.30	.61	3.44
\$3000-\$5214	12	6.02	2.02	.32	1.00	3.34
All groups	99	5.71	2.14	.30	.74	3.18

The \$1800-\$2399 (Table 29) living group spent the most for care and repair of shoes, the \$208-\$599 group the least. The shoes bought in the \$208-\$599 group were often so cheap that they were not worth repairing after the sole had worn through. Shoe repairing was done in two homes—in both cases with no money expenditure for old shoe leather was used.

SUMMARY

Clothing and houselinen expenditures were studied from records which had been kept for a year by 99 Mississippi farm families in different sections of the state and comprising a group thought to be reasonably typical of families in those sections.

Average clothing expenditures per family for the year of the study amounted to \$203.94 in money (14 percent for materials and 86 percent for ready-made articles) and 178 hours and 24 minutes in time. As the value of family living increased, cost of clothing increased but proportion of value of family living spent on clothing decreased. Time expenditures for construction of clothing also increased with increased value of family living. An average of 13.7 percent of the total value of family living was spent on clothing. Gifts of clothing averaged \$17.15 in money and 3.5 hours in time, thus making total yearly value of clothing expenditures per family \$221.09 in money and 178 hours and 24 minutes in time.

Average money expenditures were for:—Men 60 years of age and over \$38.36, women 60 years of age and over \$18.18, husbands 26-59 years of age \$33.69, wives 26-59 years of age \$38.21, husbands 18-25 years of age \$29.05, wives 18-25 years of age \$77.24, boys 18-25 years of age \$69.72, girls 18-25 years of age \$61.78, boys 12-17 years of age \$42.82, girls 12-17 years of age \$59.11, boys 6-11 years of age \$20.94, girls 6-11 years of age \$20.77, boys under 6 years of age \$12.18, and girls under 6 years of age \$12.89.

About one-half of the clothing cost was spent for outer garments, about one-third for footwear, and the rest was divided between under garments and accessories.

Daughters, wives, and sons under 6 years have a larger number of home-made than of purchased garments. Sons or boys over 6 years and husbands have a larger number of purchased garments. In most cases, the homemade garments were cheaper than the purchased garments.

An average of 5.7 garments per family was remodeled with an average expenditure of \$3.27 in money and 27 hours and 43 minutes in time. The families having a lower value of family living remodeled a few more garments than families with higher value of family living.

Both money and time expenditures for clothing were greater in the fall and spring than in the winter and summer. Money expenditures for clothing were affected by value of family living, composition of family, distance of family from church, and education of operator and homemaker. With an increase in size of family husbands' and wives' clothing expenditures show a decrease and children's an increase. The decrease is greater in wives' than husbands' clothing. Clothing expenditures were somewhat greater for the first boy or girl of a certain age than for the third or fourth boy or girl of the same age.

Average houselinen expenditures per family amounted to \$9.19 in money (55 percent for materials and 45 percent for ready-made articles) and 46 hours and 42 minutes in time. Value of houselinen increased somewhat irregularly with increased value of family living. Proportion of average total value of family living spent on houselinen decreased as value of family living increased. Time expenditures for the various value of family living groups varied irregularly. An average of .6% of the total value of family

living was spent on houselinen. Gifts of houselinen average \$1.19 in money and 19 minutes in time, thus making total value of houselinen per family \$10.39 in money and 47 hours and 1 minute in time.

An analysis of the average number of homemade and purchased articles of houselinen per family indicates that for most of the articles included in the table there are a larger number of homemade than of purchased articles. Pillow cases, quilts, scarfs, and sheets were the articles most frequently made at home.

An average of .5 article of houselinen per family was remodeled with an average expenditure of 65 cents in money and 8 hours in time. Quilts were the principal articles remodeled. Remodeling of houselinen was done more often in lower family living groups than in higher family living groups.

Both money and time expenditures for houselinen were greater in the fall and winter than in any other season. Money expenditures for houselinen were affected by value of family living and education of homemaker.

Miscellaneous money expenditures for clothing and houselinen averaged \$1.28 per family.

Average expenditure for laundry per family per week amounted to 34 cents in money, 6 hours and 1 minute in time, and 11 cents for laundry supplies. As value of family living increased time expenditure for laundry decreased and money expenditure increased. Time expenditures for laundry were slightly greater in the summer than in the other three seasons. Expenditures for laundry are affected by value of family living, composition of family, and by water connections.

Average expenditures for dry cleaning per family per year amounted to \$3.11 in money, 4 hours and 12 minutes in time, and 7 cents for dry cleaning supplies. As value of family living increased money expenditures for dry cleaning increased. There seemed to be no relation in time expenditures for dry cleaning and value of family living.

Dyeing was done in only 10 of the 99 homes. A total of \$1.50 in money and 27 hours in time was spent in dyeing textile articles in these 10 homes.

Time expenditures for mending per family per week averaged 1 hour and 42 minutes. There was more relation between composition of family and time expenditures for mending than in value of family living and time expenditures for mending.

Yearly expenditures per family for repair and care of shoes were as follows: repair of shoes \$2.14, shoe shines 30 cents, and shoe polish 74 cents.

APPENDIX

Supplementary Tables and Schedules

Table I—Average number and cost of homemade and purchased garments per person classified by age and sex, for 99 farm families of Mississippi 1928-29

Number of men 14.

Number of families 13.

		Men 60 years and over						
				Average number of garments		Average cost (to nearest penny)		
Garments		Persons with expenditure		Per person	Per person with expendi- ture	Per person	Per person with expendi- ture	Per garment
Outer Garments:								
Shirts	Hm.....	No.	%	No.	No.	\$	\$	\$
	Pur.....	2	14	.64	4.50	.49	3.40	.76
		12	86	3.71	4.33	4.14	5.50	1.27
Under Garments:								
B. V. Ds	Hm.....	.....	.....	.....	.....	.....	.....	.....
	Pur.....	6	43	.71	1.67	.54	1.26	.75
Trunks	Hm.....	2	14	.21	1.50	.14	.95	.63
	Pur.....	1	7	.21	3.00	.07	1.00	.33
Night shirts	Hm.....	2	14	.21	1.50	.10	.69	.46
and pajamas	Pur.....	1	7	.07	1.00	.09	1.25	1.25

Table I (Cont'd) Average number and cost of homemade and purchased garments per person, classified by age and sex, for 99 farm families of Mississippi 1928-29

Number of husbands 82.

Number of families 82.

Husbands 26-59 years

Garments	Persons with expenditure		Average number of garments		Average cost (to nearest penny)		
			Per person	Per person with expenditure	Per person	Per person with expenditure	Per garment
	No.	%	No.	No.	\$	\$	\$
Outer Garments:							
Shirts Hm.....	10	12	.28	2.30	.23	1.91	.83
Pur.....	72	88	3.71	4.22	4.46	5.08	1.20
Under Garments:							
B. V. Ds Hm.....	1	1	.04	3.00	.02	1.25	.42
Pur.....	44	54	1.13	2.11	1.09	2.03	.96
Trunks Hm.....	3	4	.09	2.33	.02	.57	.24
Pur.....	1	1	.01	1.00	.01	.60	.60
Night Shirts Hm.....	8	10	.12	1.25	.08	.77	.62
and Pajamas Pur.....	2	2	.03	1.50	.03	1.17	.78

Table I (Cont'd) Average number and cost of homemade and purchased garments per person, classified by age and sex, for 99 farm families of Mississippi 1928-29

Number of husbands 2

Number of families 2

Husbands 18-25 years

Garments	Persons with expenditure		Average number of garments		Average cost (to nearest penny)		
			Per person	Per person with expenditure	Per person	Per person with expenditure	Per garment
	No.	%	No.	No.	\$	\$	\$
Outer Garments:							
Shirts Hm.....	1	50	1.00	2.00	.75	1.50	.75
Pur.....	1	50	.50	1.00	.50	1.00	1.00
Under Garments:							
B. V. Ds Hm.....	...	...	...	...	...	...	...
Pur.....	1	50	.50	1.00	.25	.49	.49
Trunks Hm.....	...	...	...	...	...	...	...
Pur.....	...	...	...	...	...	...	...
Night Shirts Hm.....	...	...	...	...	...	...	...
and Pajamas Pur.....	...	...	...	...	...	...	...

Table I (Cont'd) Average number and cost of homemade and purchased garments per person, classified by age and sex, for 99 farm families of Mississippi 1928-29

Number of boys 16

Number of families 14

Boys 18-25 years

Garments	Persons with expenditure		Average number of garments		Average cost (to nearest penny)		
			Per person	Per person with expenditure	Per person	Per person with expenditure	Per garment
	No.	%	No.	No.	\$	\$	\$
Outer Garments:							
Shirts Hm.....	...	...	...	...	...	...	...
Pur.....	15	94	5.00	5.20	7.67	8.19	1.57
Under Garments:							
B. V. Ds Hm.....	1	6	.25	4.00	.09	1.38	.35
Pur.....	9	56	1.06	1.89	.85	1.51	.80
Trunks Hm.....	...	...	...	...	...	...	...
Pur.....	1	6	.25	4.00	.25	4.00	1.00
Night Shirts Hm.....	1	6	.13	2.00	.10	1.60	.80
and Pajamas Pur.....	1	6	.13	2.00	.28	4.40	2.20

Table 1 (Cont'd) Average number and cost of homemade and purchased garments per person, classified by age and sex, for 99 farm families of Mississippi 1928-29

Number of boys 62
Number of families 44

		Boys 11-17 years					
		Average number of garments			Average cost (to nearest penny)		
Garments	Persons with expenditure		Per person	Per person with expenditure	Per person	Per person with expenditure	Per garment
	No.	%					
Outer Garments:							
Shirts	Hm.....	21	34	.84	2.48	.42	.51
	Pur.....	57	92	4.26	4.63	4.59	1.07
Under Garments:							
B. V. Ds	Hm*.....	2	3	.13	4.00	.05	.41
	Pur.....	41	66	1.37	2.07	1.08	.79
Trunks	Hm.....	1	2	.02	1.00	.....	.25
	Pur.....	2	3	.06	2.00	.05	.75
Night Shirts	Hm*.....	5	8	.15	1.80	.07	.51
and Pajamas	Pur.....	1	2	.02	1.00	.03	1.80

Table 1 (Cont'd) Average number and cost of homemade and purchased garments per person, classified by age and sex, for 99 farm families of Mississippi 1928-29

Number of boys 62
Number of families 52

		Boys 6-11 years					
		Average number of garments			Average cost (to nearest penny)		
Garments	Persons with expenditure		Per person	Per person with expenditure	Per person	Per person with expenditure	Per garment
	No.	%					
Outer Garments:							
Shirts	Hm.....	32	52	1.85	3.59	.81	.44
	Pur.....	43	69	2.32	3.35	1.81	.78
Under Garments:							
B. V. Ds	Hm*.....	4	6	.13	2.00	.03	.21
	Pur.....	18	29	.63	2.17	.31	.49
Trunks	Hm.....	.....	.....	.....	.....	.....	.....
	Pur.....	.....	.....	.....	.....	.....	.....
Night Shirts	Hm.....	9	15	1.77	1.23	.07	.41
and Pajamas	Pur.....	.....	.....	.....	.....	.....	.....

Table 1 (Cont'd) Average number and cost of homemade and purchased garments per person, classified by age and sex, for 99 farm families of Mississippi 1928-29

Number of boys 34
Number of families 29

		Boys under 6 years					
		Average number of garments			Average cost (to nearest penny)		
Garments	Persons with expenditure		Per person	Per person with expenditure	Per person	Per person with expenditure	Per garment
	No.	%					
Outer Garments:							
Suits	Hm.....	14	41	1.12	2.71	.96	.86
	Pur.....	21	62	1.03	1.67	1.73	1.68
Dresses and	Hm*.....	7	21	.71	3.43	.26	.37
Aprons	Pur.....	1	3	.03	1.00	.03	1.00
Rompers	Hm.....	10	29	1.24	4.20	.52	.42
	Pur.....	2	6	.09	1.50	.04	.50
Blouses	Hm.....	8	24	.76	3.25	.26	.34
	Pur.....	1	3	.06	2.00	.03	.50
Under Garments:							
Slips	Hm.....	3	9	.26	3.00	.05	.18
	Pur.....	.....	.....	.....	.....	.....	.....
Bodies	Hm.....	1	3	.06	2.00	.....	.05
	Pur.....	.....	.....	.....	.....	.....	.....
Drawers	Hm*.....	3	9	.32	3.67	.01	.04
	Pur.....	.....	.....	.....	.....	.....	.....
B. V. Ds	Hm.....	4	12	.35	3.00	.03	.23
	Pur.....	3	9	.18	2.00	.10	.57
Gowns and	Hm*.....	9	26	.68	2.56	.09	.13
Pajamas	Pur.....	1	3	.06	2.00	.03	.49

Table I (Cont'd) Average number and cost of homemade and purchased garments per person, classified by age and sex, for 99 farm families of Mississippi 1928-29

Number of women 6		Number of families 6		Women 60 years and over			
Garments		Persons with expenditure		Average number of garments		Average cost (to nearest penny)	
				Per person	Per person with expenditure	Per person	Per person with expenditure
		No.	%	No.	No.	\$	\$
Outer Garments:							
Cotton	Hm.....	4	67	1.50	2.25	2.23	3.84
Dresses	Pur.....	4	67	1.00	1.50	1.98	2.97
Silk	Hm.....	.....	.....	.....	.....	.....	.....
Dresses	Pur.....	1	17	.17	1.00	1.50	9.00
Woolen	Hm.....	1	17	.17	1.00	.67	4.00
Dresses	Pur.....	.....	.....	.....	.....	.....	.....
Smocks	Hm.....	.....	.....	.....	.....	.....	.....
	Pur.....	.....	.....	.....	.....	.....	.....
Cotton Coats	Hm.....	.....	.....	.....	.....	.....	.....
	Pur.....	.....	.....	.....	.....	.....	.....
Skirts	Hm.....	1	17	.17	1.00	.15	.90
	Pur.....	.....	.....	.....	.....	.....	.....
Blouses	Hm.....	1	17	.17	1.00	.05	.30
	Pur.....	.....	.....	.....	.....	.....	.....
Aprons	Hm*.....	3	50	1.17	2.33	.21	.42
	Pur.....	.....	.....	.....	.....	.....	.....
Under Garments:							
Step-ins	Hm.....	1	17	.17	1.00	.03	.20
	Pur.....	.....	.....	.....	.....	.....	.....
Teddies	Hm.....	.....	.....	.....	.....	.....	.....
	Pur.....	.....	.....	.....	.....	.....	.....
Bloomers	Hm.....	1	17	.33	2.00	.21	1.25
(cotton)	Pur.....	1	17	.33	2.00	.17	1.00
Slips and	Hm.....	2	33	.33	1.00	.52	1.56
Petticoats	Pur.....	.....	.....	.....	.....	.....	.....
Brassieres	Hm.....	.....	.....	.....	.....	.....	.....
	Pur.....	.....	.....	.....	.....	.....	.....
Gowns and	Hm.....	2	33	.67	2.00	.54	1.63
Pajamas	Pur.....	.....	.....	.....	.....	.....	.....
Kimonas and	Hm.....	.....	.....	.....	.....	.....	.....
Bathrobes	Pur.....	.....	.....	.....	.....	.....	.....

Table 1 (Cont'd) Average number and cost of homemade and purchased garments per person, classified by age and sex, for 99 farm families of Mississippi 1928-29

Number of women 94
Number of families 94

Wives 26-59 years

Garments		Average number of garments				Average cost (to nearest penny)		
		Persons with expenditure		Per person	Per person with expenditure	Per person	Per person with expenditure	Per garment
		No.	%	No.	No.	\$	\$	\$
Outer Garments:								
Cotton	Hm.....	79	84	3.18	3.78	4.01	4.77	1.26
Dresses	Pur.....	60	64	1.59	2.48	2.74	4.29	1.73
Silk	Hm.....	28	30	.36	1.21	1.62	5.42	4.47
Dresses	Pur.....	32	34	.47	1.38	4.97	14.61	10.63
Woolen	Hm.....	8	9	.09	1.00	.28	3.34	3.34
Dresses	Pur.....	8	9	.11	1.25	.79	9.27	7.42
Smocks	Hm.....	1	1	.01	1.00	.01	.93	.93
	Pur.....	.....	.....	.....	.....	.....	.....	.....
Cotton	Hm.....	1	1	.01	1.00	.01	1.00	1.00
Coats	Pur.....	.....	.....	.....	.....	.....	.....	.....
Skirts	Hm.....	1	1	.01	1.00	.02	2.00	2.00
	Pur.....	.....	.....	.....	.....	.....	.....	.....
Blouses	Hm.....	1	1	.01	1.00	.03	2.68	2.68
	Pur.....	.....	.....	.....	.....	.....	.....	.....
Aprons	Hm*.....	41	44	1.20	2.70	.17	.39	.15
	Pur.....	3	3	.03	1.00	.02	.56	.56
Under Garments:								
Step-ins	Hm.....	11	12	.23	2.00	.05	.46	.23
	Pur.....	6	6	.10	1.50	.07	1.12	.75
Teddies	Hm.....	13	14	.33	2.38	.11	.79	.33
	Pur.....	13	14	.24	1.77	.17	1.22	.73
Bloomers	Hm.....	11	12	.20	1.60	.07	.62	.38
(cotton)	Pur.....	11	12	.20	1.82	.13	1.10	.61
Slips and	Hm.....	44	47	.85	1.82	.46	.97	.53
Petticoats	Pur.....	18	19	.28	1.44	.39	2.02	1.40
Brassieres	Hm.....	6	6	.13	2.00	.01	.16	.08
	Pur.....	14	15	.18	1.21	.08	.56	.46
Gowns and	Hm.....	36	38	.78	2.03	.47	1.25	.61
Pajamas	Pur.....	18	19	.29	1.50	.26	1.36	.91
Kimonos and	Hm.....	4	4	.04	1.00	.07	1.62	1.63
Bath Robes	Pur.....	2	2	.02	1.00	.05	2.55	2.55

Table I (Cont'd) Average number and cost of homemade and purchased garments per person, classified by age and sex, for 99 farm families of Mississippi 1928-29

Number of women 4
Number of families 4

Wives 18-25 years

Garments		Persons with expenditure		Average number of garments		Average cost (to nearest penny)		
				Per person	Per person with expenditure	Per person	Per person with expenditure	Per garment
Outer Garments:								
Cotton	Hm.....	4	100	4.00	4.00	5.99	5.99	1.50
Dresses	Pur.....	2	50	2.25	4.50	4.90	9.80	2.18
Silk	Hm.....	.....	.....	.....	.....	.....	.....	.....
Dresses	Pur.....	1	25	.50	2.00	4.38	17.50	8.75
Woolen	Hm.....	1	25	.25	1.00	2.08	8.30	8.30
Dresses	Pur.....	1	25	.25	1.00	1.65	6.60	6.60
Smocks	Hm.....	.....	.....	.....	.....	.....	.....	.....
	Pur.....	.....	.....	.....	.....	.....	.....	.....
Cotton	Hm.....	.....	.....	.....	.....	.....	.....	.....
Coats	Pur.....	.....	.....	.....	.....	.....	.....	.....
Skirts	Hm.....	1	25	.25	1.00	.74	2.95	2.95
	Pur.....	.....	.....	.....	.....	.....	.....	.....
Blouses	Hm.....	.....	.....	.....	.....	.....	.....	.....
	Pur.....	.....	.....	.....	.....	.....	.....	.....
Aprons	Hm.....	1	25	.25	1.00	.13	.53	.53
	Pur.....	.....	.....	.....	.....	.....	.....	.....
Under Garments:								
Step-ins	Hm*.....	.....	.....	.....	.....	.....	.....	.....
	Pur.....	.....	.....	.....	.....	.....	.....	.....
Teddies	Hm*.....	1	25	.50	2.00	.10	.40	.20
	Pur.....	.....	.....	.....	.....	.....	.....	.....
Bloomers (cotton)	Hm*.....	.....	.....	.....	.....	.....	.....	.....
	Pur.....	2	50	1.25	2.50	.71	1.43	.57
Slips and	Hm*.....	1	25	.50	2.00	.39	1.50	.75
Petticoats	Pur.....	2	50	.50	1.00	.88	1.75	1.75
Brassieres	Hm*.....	.....	.....	.....	.....	.....	.....	.....
	Pur.....	1	25	.25	1.00	.09	.35	.35
Gowns and	Hm*.....	.....	.....	.....	.....	.....	.....	.....
Pajamas	Pur.....	1	25	.25	1.00	.17	.69	.69
Kimonas and	Hm.....	.....	.....	.....	.....	.....	.....	.....
Bathrobes	Pur.....	.....	.....	.....	.....	.....	.....	.....

Table I (Cont'd) Average number and cost of homemade and purchased garments per person, classified by age and sex, for 99 farm families of Mississippi 1928-29

Number of girls 20

Number of families 18

Girls 18-25 years

Garments		Persons with expenditure		Average number of garments		Average cost (to nearest penny)		
				Per person	Per person with expenditure	Per person	Per person with expenditure	Per garment
		No.	%	No.	No.	\$	\$	\$
Outer Garments:								
Cotton	Hm.....	16	80	3.70	4.63	4.15	5.19	1.12
Dresses	Pur.....	10	50	1.30	2.60	2.35	4.69	1.80
Silk	Hm.....	7	35	.45	1.29	1.87	5.38	4.15
Dresses	Pur.....	10	50	1.35	2.70	10.69	21.39	7.92
Woolen	Hm.....	1	5	.05	1.00	.16	3.17	3.17
Dresses	Pur.....							
Smocks	Hm.....	2	10	.10	1.00	.08	.82	.82
	Pur.....							
Cotton	Hm.....	2	10	.10	1.00	.12	1.21	1.21
Coats	Pur.....	1	5	.05	1.00	.04	.75	.75
Skirts	Hm.....	1	5	.05	1.00	.05	1.06	1.06
	Pur.....	2	10	.10	1.00	.39	3.94	3.94
Blouses	Hm.....	2	10	.10	1.00	.14	1.43	1.43
	Pur.....	2	10	.10	1.00	.09	.87	.87
Aprons	Hm*.....	5	25	.35	1.40	.05	.19	.14
	Pur.....	1	5	.05	1.00	.02	.49	.49
Under Garments:								
Step-ins	Hm.....	5	25	.45	1.80	.06	.26	.14
	Pur.....	2	10	.20	2.00	.12	1.19	.60
Teddies	Hm.....	4	20	.45	2.25	.18	.91	.40
	Pur.....	1	5	.05	1.00	.05	1.00	1.00
Bloomers	Hm.....	4	20	.35	1.75	.11	.57	.33
(cotton)	Pur.....	4	20	.40	2.00	.19	.95	.47
Slips and	Hm.....	14	70	1.15	1.64	.80	1.15	.70
Petticoats	Pur.....	4	20	.25	1.25	.21	1.05	.84
Brassieres	Hm.....	4	20	.35	1.75	.05	.23	.13
	Pur.....	8	40	.85	2.13	.17	.43	.20
Gowns and	Hm.....	7	35	.50	1.43	.45	1.29	.90
Pajamas	Pur.....	4	20	.30	1.50	.20	.99	.66
Kimonas and	Hm.....	4	20	.25	1.25	.41	2.03	1.62
Bathrobes	Pur.....	1	5	.05	1.00	.15	3.00	3.00

Table I (Cont'd) Average number and cost of homemade and purchased garments per person, classified by age and sex, for 99 farm families of Mississippi 1928-29

Number of girls 59		Girls 12-17 years						
Number of families 45		Average number of garments				Average cost (to nearest penny)		
Garments		Persons with expenditure		Per person	Per person with expenditure	Per person	Per person with expenditure	Per garment
		No.	%	No.	No.	\$	\$	\$
Outer Garments:								
Cotton	Hm.....	59	100	5.80	5.80	6.92	6.92	1.19
Dresses	Pur.....	32	54	1.24	2.28	2.18	4.02	1.76
Silk	Hm.....	26	44	.58	1.31	3.25	7.37	5.64
Dresses	Pur.....	24	41	.68	1.67	5.24	12.88	7.73
Woolen	Hm.....	7	12	.12	1.00	.46	3.89	3.89
Dresses	Pur.....	5	8	.08	1.00	.40	4.75	4.75
Smocks	Hm.....	5	8	.12	1.40	.12	1.44	1.03
	Pur.....	1	2	.02	1.00	.03	1.50	1.50
Cotton	Hm.....	7	12	.14	1.14	.26	2.18	1.90
Coats	Pur.....							
Skirts	Hm.....	7	12	.12	1.00	.36	3.08	3.08
	Pur.....	2	3	.03	1.00	.15	4.48	4.48
Blouses	Hm.....	3	5	.05	1.00	.07	1.42	1.42
	Pur.....	2	3	.03	1.00	.05	1.55	1.55
Aprons	Hm*.....	6	10	.14	1.33	.24	.23	.18
	Pur.....							
Under Garments:								
Step-ins	Hm.....	16	27	.59	2.19	.15	.54	.25
	Pur.....	2	3	.03	1.00	.02	.63	.63
Teddies	Hm.....	9	15	.31	2.00	.10	.66	.33
	Pur.....	3	5	.07	1.33	.04	.80	.60
Bloomers (cotton)	Hm.....	24	41	.88	2.17	.50	1.23	.57
	Pur.....	17	29	.47	1.65	.25	.87	.53
Slips and Petticoats	Hm*.....	44	75	1.34	1.80	.87	1.19	.66
	Pur.....	8	14	.14	1.00	.14	1.05	1.05
Brassieres	Hm*.....	9	15	.36	2.33	.04	.27	.11
	Pur.....	27	46	1.15	2.52	.32	.70	.28
Gowns and Pajamas	Hm.....	30	51	.75	1.47	.56	1.08	.75
	Pur.....	7	12	.15	1.29	.16	1.39	1.08
Kimonas and Bathrobes	Hm.....	5	8	.08	1.00	.18	2.09	2.09
	Pur.....							

Table I (Cont'd) Average number and cost of homemade and purchased garments per person, classified by age and sex, for 99 farm families of Mississippi 1928-29

Number of girls 62 Number of families 47		Girls 6-11 years						
		Average number of garments			Average cost (to nearest penny)			
Garments	Persons with expenditure		Per person	Per person with expendi- ture	Per person	Per person with expendi- ture	Per garment	
	No.	%						
Outer Garments:	No.	%	No.	No.	\$	\$	\$	
Cotton	Hm.....	58	94	4.26	4.55	3.33	3.54	.78
Dresses**	Pur.....	23	37	1.08	2.90	1.30	3.49	1.20
Silk	Hm.....	9	15	.15	1.00	.34	2.34	2.34
Dresses	Pur.....	8	13	.15	1.13	.37	2.85	2.53
Woolen	Hm.....	7	11	.11	1.00	.24	2.13	2.13
Dresses	Pur.....	1	2	.02	1.00	.04	2.75	2.75
Cotton	Hm.....	1	2	.02	1.00	.01	.65	.65
Coats	Pur.....	.....	.....	.....	.....	.....	.....	.....
Skirts	Hm.....	1	2	.02	1.00	.01	.50	.50
	Pur.....	2	3	.03	1.00	.03	1.04	1.04
Blouses	Hm.....	.....	.....	.....	.....	.....	.....	.....
	Pur.....	1	2	.02	1.00	.02	1.00	1.00
Aprons	Hm.....	2	3	.03	1.00	.01	.25	.25
	Pur.....	.....	.....	.....	.....	.....	.....	.....
Under Garments:								
Step-ins and	Hm*.....	7	11	.24	2.14	.03	.28	.13
Drawers	Pur.....	.....	.....	.....	.....	.....	.....	.....
Teddies	Hm*.....	13	21	.36	1.70	.09	.44	.25
	Pur.....	4	6	.10	1.50	.04	.70	.46
Bloomers	Hm.....	34	55	1.35	2.47	.48	.87	.35
(cotton)	Pur.....	21	34	.79	2.33	.37	1.10	.47
Slips and	Hm.....	32	52	.85	1.66	.47	.91	.35
Petticoats	Pur.....	5	8	.11	1.40	.06	.77	.55
Gowns and	Hm*.....	13	21	.26	1.23	.07	.32	.26
Pajamas	Pur.....	.....	.....	.....	.....	.....	.....	.....
Kimonas and	Hm.....	1	2	.02	1.00	.02	1.25	1.25
Bathrobes	Pur.....	.....	.....	.....	.....	.....	.....	.....
**Includes bloomer dresses								

**Includes bloomer dresses.

Table I (Cont'd) Average number and cost of homemade and purchased garments per person, classified by age and sex, for 99 farm families of Mississippi 1928-29

Number of girls 38 Number of families 26		Girls under 6 years						
		Average number of garments			Average cost (to nearest penny)			
Garments		Persons with expenditure		Per person	Per person with expendi- ture	Per person	Per person with expendi- ture	Per garment
		No.	%					
Outer Garments:								
Cotton	Hm.....	28	74	4.70	6.40	2.24	3.04	.48
Dresses**	Pur.....	8	21	.95	4.50	.78	3.73	.83
Silk	Hm.....	6	16	.16	1.00	.36	2.25	2.25
Dresses	Pur.....	1	3	.13	5.00	.27	10.15	2.03
Woolen	Hm.....	5	13	.18	1.40	.28	2.15	1.53
Dresses	Pur.....							
Cotton	Hm.....	2	5	.05	1.00	.02	.35	.35
Coats	Pur.....							
Skirts	Hm.....	2	5	.05	1.00	.02	.44	.44
	Pur.....	1	3	.03	1.00	.04	1.50	1.50
Aprons	Hm*	8	21	.66	3.13	.15	.69	.22
	Pur.....							
Rompers	Hm.....							
	Pur.....	2	5	.08	1.50	.03	.58	.38
Under Garments:								
Drawers	Hm*.....	3	8	.26	3.33		.03	.01
	Pur.....							
Teddies	Hm.....							
	Pur.....	1	3	.03	1.00	.03	1.25	1.25
Bloomers	Hm*.....	11	29	1.21	4.18	.19	.66	.16
(cotton)	Pur.....	3	8	.21	2.67	.04	.47	.18
Slips	Hm.....	9	24	.55	2.33	.11	.48	.20
	Pur.....	3	8	.29	3.67	.11	1.42	.39
Bodies	Hm.....	3	8	.21	2.67	.02	.19	.07
	Pur.....	4	11	.21	2.00	.06	.56	.25
Gowns and	Hm*.....	6	16	.34	2.17	.05	.35	.16
Pajamas	Pur.....	3	8	.29	3.67	.12	1.47	.40
Diapers	Hm.....	2	5	.45	8.50	.06	1.23	.14
	Pur.....	2	5	.63	12.00	.08	1.44	.12
**Includes bloomer dresses.								

**Includes bloomer dresses.

Table II—Average number and cost of homemade and purchased articles per family. 7 families, family earnings \$208-\$599 per year

		Families with expenditure		Average number of articles		Average cost		
Articles		number	percent	Per family	Per family with expenditure	Per family	Per family with expenditure	Per article
Napkins	Hm.....	1	14	1.14	8.00	.04	.29	.04
	Pur.....	...	...	...	...	...	...	...
Pillow Cases (bed)	Hm.....	4	57	1.00	1.75	.33	.58	.33
	Pur.....	...	...	...	...	...	...	...
Quilts	Hm*.....	4	57	.71	1.25	1.20	2.11	16.8
	Pur.....	...	...	...	...	...	...	...
Rag Rugs	Hm*.....	1	14	.14	1.00	.....	.....	.....
	Pur.....	...	...	...	...	.....	.....	.....
Scarfs	Hm.....	1	14	.14	1.00	.06	.45	.45
	Pur.....	...	...	...	...	.....	.....	.....
Sheets	Hm.....	5	71	1.71	2.40	1.58	2.21	.92
	Pur.....	1	14	.29	2.00	.23	1.60	.80
Towels	Hm*.....	3	43	2.14	5.00	.03	.07	.01
	Pur.....	2	29	2.29	8.00	.36	1.26	.16

Table II (Cont'd)—Average number and cost of homemade articles per family. 31 families, family earnings \$600-\$1199 per year

		Families with expenditure		Average number of articles		Average cost		
		number	percent	Per family	Per family with expenditure	Per family	Per family with expenditure	Per article
Chair Covers	Hm*.....	1	3	.10	3.00	.01	.20	.07
	Pur.....	.....	.....	.....	.....	.....	.....	.....
Couch Covers	Hm.....	1	3	.03	1.00	.02	.51	.51
	Pur.....	.....	.....	.....	.....	.....	.....	.....
Curtains	Hm*.....	7	23	.74	3.29	.40	1.78	.54
	Pur.....	3	10	.26	2.67	.12	1.25	.47
Mattress Covers	Hm.....	.....	.....	.....	.....	.....	.....	.....
	Pur.....	1	3	.03	1.00	.03	1.00	1.00
Napkins	Hm*.....	2	6	.48	7.50	.02	.30	.04
	Pur.....	1	3	.19	6.00	.04	1.25	.....
Pillow Cases (bed)	Hm.....	20	65	2.13	3.30	.62	.97	.29
	Pur.....	5	16	.19	1.20	.21	1.30	1.08
Pillow Cases (sofa)	Hm.....	20	65	2.13	1.00	.04	.67	.67
	Pur.....	.....	.....	.....	.....	.....	.....	.....
Quilts	Hm*.....	8	26	.55	2.13	.95	3.67	1.73
	Pur.....	2	6	.10	1.50	.28	4.34	2.89
Rag Rugs	Hm*.....	1	3	.03	1.00	.03	.79	.79
	Pur.....	.....	.....	.....	.....	.....	.....	.....
Scarfs	Hm.....	7	23	.45	2.00	.17	.77	.39
	Pur.....	4	13	.29	2.25	.12	.90	.40
Sheets	Hm.....	15	48	1.58	3.27	1.24	2.56	.78
	Pur.....	2	6	.23	3.50	.21	3.23	.92
Table Cloths	Hm*.....	2	6	.10	1.50	.04	.58	.39
	Pur.....	3	10	.13	1.23	.19	1.99	1.49
Towels	Hm*.....	10	32	2.55	7.90	.....	.....	.....
	Pur.....	14	45	2.74	6.07	.54	1.19	.20

Table II (Cont'd)—Average number and cost of homemade and purchased articles per family, 23 families, family earnings \$1200-\$1799 per year

Articles		Families with expenditure		Average number of articles		Average cost		
		number	percent	Per family	Per family with expenditure	Per family	Per family with expenditure	Per article
Bath Rags	Hm.....	...	...	...	...	...	...	...
	Pur.....	5	22	.52	2.40	.03	.15	.06
Buffet Sets	Hm.....	1	4	.04	1.00	.01	.30	.30
	Pur.....	1	4	.04	1.00	.22	5.00	5.00
Curtains	Hm.....	12	52	.25	4.83	1.45	2.77	.57
	Pur.....	2	9	.17	2.00	.09	1.08	.54
Mattress	Hm.....	...	...	...	...	...	...	...
Covers	Pur.....	1	4	.04	1.00	.05	1.04	1.04
Napkins	Hm.....	...	...	...	...	...	...	...
	Pur.....	1	4	.26	6.00	.05	1.10	.18
Pillow Cases (bed)	Hm*	13	57	1.70	3.00	.46	.82	.27
	Pur.....	3	13	.17	1.33	.22	1.67	1.25
Quilts	Hm*	8	35	.43	1.25	.76	2.19	1.76
	Pur.....	...	...	...	...	...	...	...
Rag Rugs	Hm.....	...	...	...	...	...	...	...
	Pur.....	1	4	.13	3.00	.13	3.00	1.00
Scarfs	Hm.....	7	30	1.09	3.57	.34	1.11	.31
	Pur.....	4	17	.26	1.50	.24	1.47	.98
Sheets	Hm*	13	57	2.61	4.62	1.86	3.29	.71
	Pur.....	5	22	.57	2.60	.61	2.82	1.08
Table Cloths	Hm*	6	26	.30	1.17	.37	1.43	1.23
	Pur.....	6	26	.26	1.00	.52	2.01	2.01
Towels	Hm*	13	57	4.80	8.46	.17	.30	.04
	Pur.....	12	52	2.52	4.83	.48	.92	.19

Table II (Cont'd)—Average number and cost of homemade and purchased articles per family, 17 families, family earnings \$1800-\$2399 per year

Articles		Families with expenditure		Average number of articles		Average cost		
		number	percent	Per family	Per family with expenditure	Per family	Per family with expenditure	Per article
Bath Rags	Hm.....	...	...	...	...	...	...	...
	Pur.....	2	12	.18	1.50	.01	.10	.07
Chair Covers	Hm.....	2	12	.41	3.50	.14	1.15	.33
	Pur.....	...	...	...	...	...	...	...
Curtains	Hm.....	5	29	1.47	5.00	1.13	3.84	.77
	Pur.....	1	6	.06	1.00	.07	1.25	1.25
Pillow Cases (bed)	Hm*	7	41	1.24	3.00	.58	1.41	.47
	Pur.....	...	...	...	...	...	...	...
Pillow Cases (sofa)	Hm.....	2	12	.12	1.00	.04	.34	.34
	Pur.....	...	...	...	...	...	...	...
Quilts	Hm.....	3	18	.29	1.67	.61	3.43	2.06
	Pur.....	...	...	...	...	...	...	...
Scarfs	Hm.....	6	35	.47	1.33	.39	1.11	.84
	Pur.....	...	...	...	...	...	...	...
Sheets	Hm*	4	24	.82	3.50	.77	3.27	.94
	Pur.....	2	12	.41	3.50	.41	3.50	1.00
Table Cloths	Hm*	5	29	.29	1.00	.31	1.05	1.05
	Pur.....	3	18	.18	1.00	.41	2.27	2.27
Towels	Hm*	12	71	3.71	5.25	.04	.06	.01
	Pur.....	5	29	1.82	6.20	.31	1.06	.17

Table II (Cont'd)—Average number and cost of homemade and purchased articles per family, 9 families, family earnings \$2400-\$2999 per year

Articles	Families with expenditure		Average number of articles		Average cost		
	number	percent	Per family	Per family with expenditure	Per family	Per family with expenditure	Per article
Couch Covers	Hm.....	1	11	.11	1.00	.11	1.00
	Pur.....	...	...	...	...	...	...
Curtains	Hm.....	3	33	1.56	4.67	.82	2.47
	Pur.....	...	...	...	...	...	...
Napkins	Hm.....	1	11	.67	6.00	.17	1.55
	Pur.....	1	11	1.33	12.00	.20	1.78
Pillow Cases (bed)	Hm.....	3	33	.56	1.67	.21	.63
	Pur.....	...	...	...	...	...	...
Pillow Cases (sofa)	Hm.....	1	11	.67	6.00	.20	1.80
	Pur.....	...	...	...	...	...	...
Quilts	Hm*.....	1	11	.22	2.00	.27	2.44
	Pur.....	1	11	.11	1.00	.45	4.04
Scarfs	Hm.....	1	11	.22	2.00	.02	.20
	Pur.....	...	...	...	...	...	...
Sheets	Hm.....	2	22	1.33	6.00	.79	3.58
	Pur.....	3	33	1.00	3.00	.85	2.55
Table Cloths	Hm.....	2	22	.33	1.50	.96	4.33
	Pur.....	...	...	...	...	...	...
Towels	Hm*.....	2	22	1.56	7.00	.01	.03
	Pur.....	2	22	1.11	5.00	.42	1.88

*A Less than ½ penny.

Table II (Cont'd)—Average number and cost of homemade and purchased articles per family, 12 families, family earnings \$3000-\$5214 per year

Articles	Families with expenditure		Average number of articles		Average cost		
	number	percent	Per family	Per family with expenditure	Per family	Per family with expenditure	Per article
Buffet Sets	Hm.....	2	17	.17	1.00	.19	1.13
	Pur.....	...	...	...	...	...	...
Curtains	Hm.....	7	58	2.25	3.86	4.16	7.13
	Pur.....	1	8	.25	3.00	.31	3.75
Luncheon Sets	Hm.....	1	8	.08	1.00	.10	1.25
	Pur.....	...	...	...	...	...	...
Napkins	Hm.....	...	...	...	...	...	...
	Pur.....	2	17	1.00	6.00	.19	1.13
Pillow Cases (bed)	Hm.....	5	42	1.17	2.80	.57	1.38
	Pur.....	2	17	.58	3.50	.45	2.68
Pillow Cases (sofa)	Hm.....	1	8	.08	1.00	.06	.75
	Pur.....	1	8	.17	2.00	.17	2.00
Quilts	Hm.....	2	17	.33	2.00	1.13	6.75
	Pur.....	...	...	...	...	...	...
Rag Rugs	Hm*.....	1	8	.08	1.00	...	...
	Pur.....	...	...	...	...	...	...
Scarfs	Hm.....	1	8	.17	2.00	.04	.50
	Pur.....	2	17	.25	1.50	.38	2.25
Sheets	Hm.....	7	58	2.17	3.71	2.15	5.12
	Pur.....	4	33	1.50	4.50	1.71	5.13
Table Cloths	Hm.....	3	25	.42	1.67	.54	2.15
	Pur.....	1	8	.08	1.00	.10	1.25
Towels	Hm*.....	1	8	2.00	24.00	.01	.10
	Pur.....	3	25	.75	3.00	.21	.85

**Less than ½ penny.

Table III—Average number of husbands, wives and children per family by total value of family living groups. 99 farm families, Mississippi 1928-29

Groups classifying families according to total value of family living	Average number per family									
	Husbands	Wives	Boys				Girls			
			18-25 years	12-17 years	6-11 years	Under 6 years	18-25 years	12-17 years	6-11 years	Under 6 years
\$208-\$599	.86	1.00	.0	.29	.57	.43	.29	.86	1.29	.57
\$600-\$1199	.94	1.00	.16	.45	.61	.35	.26	.65	.71	.42
\$1200-\$1799	.96	1.00	.17	.83	.65	.30	.26	.57	.39	.35
\$1800-\$2399	1.00	1.00	.18	.53	.53	.24	.12	.65	.35	.35
\$2400-\$2999	1.00	1.00	.11	.78	.89	.56	.22	.33	.44	.24
\$3000-\$5214	1.00	1.00	.25	.92	.58	.33	.0	.50	1.00	.25

CLOTHING AND HOUSE LINEN

Name.....

Date: fr.....to.....

Name

Address

[illegible]

Name

Address

Date: fr.....to.....

*Make separate note of any dyeing done.

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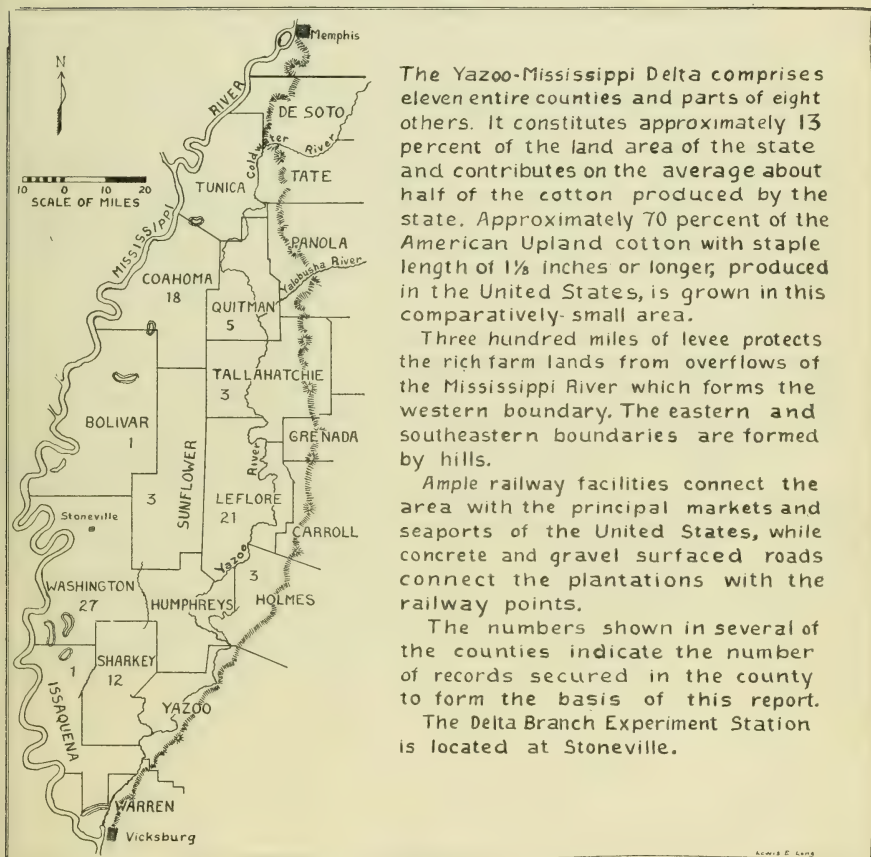
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FARM POWER IN THE YAZOO-MISSISSIPPI DELTA

By

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and Collaborator, U. S. D. A.



The Yazoo-Mississippi Delta comprises eleven entire counties and parts of eight others. It constitutes approximately 13 percent of the land area of the state and contributes on the average about half of the cotton produced by the state. Approximately 70 percent of the American Upland cotton with staple length of $1\frac{1}{8}$ inches or longer, produced in the United States, is grown in this comparatively small area.

Three hundred miles of levee protects the rich farm lands from overflows of the Mississippi River which forms the western boundary. The eastern and southeastern boundaries are formed by hills.

Ample railway facilities connect the area with the principal markets and seaports of the United States, while concrete and gravel surfaced roads connect the plantations with the railway points.

The numbers shown in several of the counties indicate the number of records secured in the county to form the basis of this report.

The Delta Branch Experiment Station is located at Stoneville.

United States Department of Agriculture
Division of Farm Management and Costs, Bureau of Agricultural Economics
Bureau of Agricultural Engineering
Division of Animal Husbandry, Bureau of Animal Industry
in cooperation with

Mississippi Agricultural Experiment Station

A. & M. COLLEGE, MISSISSIPPI

W. R. PERKINS, Director

Statement of Cooperation and Acknowledgements

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THE YAZOO-MISSISSIPPI DELTA

Location, topography, soils and climate.*

The Yazoo-Mississippi Delta, known locally as the "Mississippi Delta," comprises an area of approximately 8000 square miles of level land lying principally between the flood plains of the Yazoo River and the Mississippi River. The meanderings of these streams in forming the basin have left many lakes and the remains of old channels. The latter are represented by shallow lagoons, bayous, and lesser depressions. Numerous low sandy ridges occur, the result of overflows in the geologic past. The basin is bounded on the east by hills rising from 100 feet to 300 feet above the basin surface. Elevation above sea level ranges from about 100 feet in the southern part to 190 feet in the northern. The surface is generally level with the higher and better drained lands adjacent to the streams, lakes and old stream beds.

The soils of the basin are derived from the alluvium of the river flood plains. In the order of their relative predominance, they consist of clays, loams, and sandy loams. The usual relative position of their occurrence is sandy loam adjacent to the streams, lakes and old stream beds; loam soils in small quantities adjacent and farther from the streams and depressions; and clay, commonly called "buckshot" in the interstream areas. The soil types belong largely to the Sharkey and Yazoo series, although other series are represented by small areas.

The climate of the section is favorable for the production of a large variety of crops. The mean annual temperature is approximately 64 degrees Fahrenheit, being slightly lower in the northern part and higher in the southern part. The length of the frost-free period is approximately 230 days. Average annual rainfall ranges from about 50 inches in the northern part to 53 inches in the southern. Practically all main roads are graded and surfaced with gravel, while a considerable mileage of concrete highways has been built adjacent to the principal trading centers.

TYPE OF FARMING

The plantation system is the predominating type of farming in the Yazoo-Mississippi Delta. It is sufficiently well known as not to require a detailed description.

Records were obtained on 94 plantations, the average size of which was 1263 acres with 75 per cent in crops. Of the crop land, amounting to 952 acres per plantation on the average, 76 per cent was sandy loam and 24 per cent was "buckshot" land. In 1929, 75 per cent of the cropped land was in cotton, 15 per cent in corn, and the remaining 10 per cent in other crops. Average acreages per plantation were: cotton, 715; corn, 146; sorghums, 10; alfalfa, 28; peas and beans, 35; and other crops consisting of oats, wheat, vetch, and clovers, 18. Only cotton, corn, sorghums and peas and beans were found generally on all plantations. The alfalfa acreage was confined to about 24 plantations, and the crops listed as "other" were not grown generally.

Very little livestock was found other than workstock and milk cows and hogs for home use. The average numbers of livestock kept per plantation, omitting fractions, were: work animals, 48; other horses and mules, 1; milk cows, 17; beef cattle, 1; young cattle, 7; hogs, 60; and sheep, 1. No record was made of poultry kept. Work-stock, milk cows and hogs were found on practically all plantations. Beef cattle and sheep were found in small numbers on perhaps a half dozen plantations.

Reports were obtained on 64 plantations as to the number of cropper families on the place, and 92 operators, including the preceding 64, reported the total number of hands on the place. The average number of cropper families, based on 64 reports, was 43. The average number of hands per

* Adapted from "Soils of Mississippi", Technical Bulletin No. 7, Mississippi Agricultural Experiment Station. By William N. Logan.

plantation, based on 92 reports, was 127. This figure includes share croppers and members of their families who work, day and month hands, hostlers, and blacksmiths, who were employed for 200 or more days during the year. It does not include special labor hired for short periods as for cotton chopping and picking.

METHOD OF STUDY

The increasing number of requests for information in regard to the economy of tractor and truck ownership and operation has created an urgent demand for more detailed information in regard to farm power units. This study was undertaken to supply such a demand.

In March 1930, ninety-four plantation operators, 66 of whom used tractors and mules and 28 who used mules only on their plantations, were interviewed in ten counties of the Yazoo-Mississippi Delta and records for the year 1929 were obtained for each plantation showing the amount of land operated, the distance to market, kind of roads, acreage and yield of crops, livestock kept and feed used, workstock, equipment, labor supply, complete data on ownership and operation of tractors and trucks with their equipment; planting, tillage and harvest operations on all crops; and a few miscellaneous items. Where possible, actual figures were obtained; otherwise, the estimates of the operators were used.

Only for the averages shown in the discussion pertaining to type of farming was the entire number of records included. Numerous different sortings were made in tabulating the data subsequently shown. Where the recorded data were incomplete or plainly erroneous, such data were excluded from the tabulations.

The same field data are being used by the United States Department of Agriculture in preparing the report for the broader study of which this is a part. Should differences appear in the two reports, they may be attributed to differences in method, and data may be included in one which have been excluded from the other.

In general, only such phases of farming as were considered important by the plantation operators interviewed will be considered. Such items as family living, automobile operation, poultry, and gardens will not be considered.

It is not the intention to make an intensive cost analysis, but relative costs will be kept in mind and cost estimates will be freely introduced. Where the number of observations was sufficiently large and the nature of the data was such as to give value to an average, the data were averaged. These data are shown by tables. Data unadapted for tabulation and specific cases are discussed in the text.

TRACTORS

Age and History.

Sixty-six plantation operators owned tractors. Most of these were using the first tractor which they had ever owned, but some had been using tractors for a number of years. The earliest purchases of tractors reported were made in 1915. From that date until April 1, 1929, one hundred and seventy-one tractors had been purchased by the group, of which 122 were still in use and 49 had been sold, traded or junked. Up to 1922, the group had purchased only twelve tractors representing six makes. These appeared to be ill-adapted to conditions or of poor construction and, in a few cases, were discarded after one year's use. In 1922, eleven tractors were purchased representing two makes. These tractors were more satisfactory and tractors of similar make are still found on Delta plantations. Purchases have gradually increased since, and the tendency to substitute mechanical for mule power shows a marked upward trend. Five makes of tractors were encountered in 1929. These were generally assorted according to type into two

classes for tabulating: general purpose tractors, or those adaptable to planting and cultivating as well as other drawbar and belt work, and ordinary tractors, or those not adaptable to planting and cultivating. The former class predominated on the plantations studied and were usually newer.

For 78 tractors constituting the first tractors purchased by the operators interviewed, the following H. P. ratings were given: three 8-16's; twenty-five 9-18's; forty-four 10-20's; two 12-23's; three 15-30's; and one 10-ton, the latter being of the tracklaying type. At the present time, the 10-20 general purpose tractor predominates.

Information was obtained regarding the disposal of 45 of the 49 tractors sold, traded or junked. Of these, six were sold at an average of \$100 each, fifteen were traded with an average value in trade of \$184 each, and twenty-four were junked. The average life of those junked was four years, while those disposed of averaged 2.7 years of age at time of disposal.

Tractor Equipment.

Varying kinds and amounts of equipment were found to be associated with tractors. Generally, the older tractors were adaptable only to disking, plowing, grading and belt work. In fact, quite a number of the plantation operators interviewed kept tractors only for these purposes, whether the tractor was old or new. Not infrequently where several tractors were owned, one, usually somewhat larger, was kept expressly for hard plowing, grading and ditching. The newer tractors were mostly of the general purpose type, adaptable to a wide variety of uses by the interchange of equipment. An idea of these uses may be obtained from Table 1, which shows the kinds and numbers of tractor-operated machines on the plantations studied.

FLAT BREAKING COTTON LAND

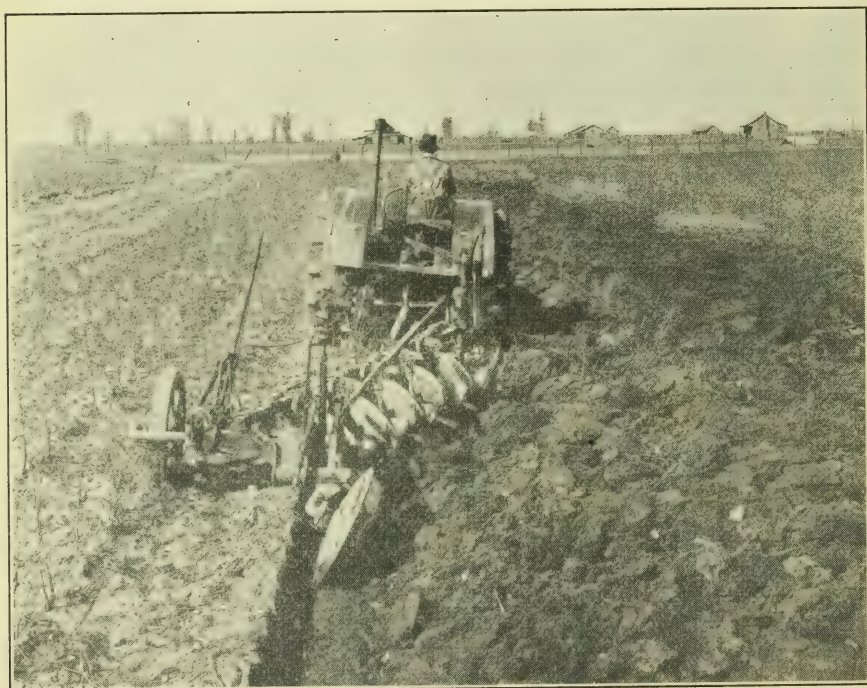


Fig. I—Here is shown a 5-bottom disk gang operating successfully in tough land. The power unit is a 15-30 I. H. C. tractor, a type and size commonly used for heavy plowing, grading and ditching.

Table 1. Showing number reported and annual charges for use of certain tractor equipment

Item	Unit	Tractor equipment					
		2-bottom disk plow	6, 7 & 8' tandem disks	2-row middle buster	4-row planter	4-row cultivator	7 ft. Mower
Plantations reporting	number	20	50	31	18	19	21
Machines	number	25	81	39	22	27	25
First cost	dollar	125.88	129.09	103.21	227.27	266.88	111.64
Estimated life	years	5.8	5.1	5.8	6.0	5.0	5.6
Charges:							
Depreciation*	dollar	21.72	25.31	17.79	37.88	53.58	19.94
Interest**	dollar	3.78	3.87	3.10	6.82	8.01	3.35
Annual repairs	dollar	2.80	6.45	1.79	1.27	5.26	4.48
Total Annual charge***	dollar	28.30	35.63	22.68	45.97	66.65	27.77

* Based on average estimated life.

** Six per cent on one-half of first cost.

*** No charge has been made for housing.

Disks far outnumbered any other item of equipment used with tractors, which is to be expected since the disk is a very common farm tool and no special arrangement is necessary for operating it with a tractor of any age or design. The plows were mostly of the 2-bottom disk gang type although some moldboard gangs were used. Middle busters represented were all 2-row and special equipment for the more modern tractors. Planters and cultivators were, likewise, special equipment with 4-row outfits predominating. Section harrows were often attached behind other implements and operated with a tractor, and considerable straight section harrowing was done with tractor power. However, only a few harrows were listed as tractor equipment since these implements are converted from a mule to a tractor-implement with the simple addition of a few sections. Grain drills were few on the plantations studied. Of tractor operated haying tools, mowers were the most common. These were, with a few exceptions, special equipment with power take-off to the cutting mechanism. Tractor operated rakes were, as a rule, sweep rakes although occasionally a side delivery rake was so operated. While hay presses were generally listed as tractor equipment by the plantation operators, not all of them belong in this class. Only about half of the presses were operated with tractor belt power. The remainder were merely transported with tractors and operated with auxiliary gas engines mounted on the frame of the press. The same was true of the combines. Graders and ditchers varied greatly in size and design.

The uses to which a general purpose tractor may be put are very numerous when adequate equipment is available.

No allowance is made in Table 1 for junk values. On the other hand, oil and grease are not included as an operating cost. Individual owners will probably find that the period of usefulness varies with amount of annual use and the general care of the machine. The data are introduced here as a means of estimating costs of performing certain farming operations with tractor power. This table shows only the more common equipment, or those machines occurring in sufficient numbers to permit of averaging.

Range of Usefulness.

A total of eighteen different operations was performed with tractor power on the plantations studied. Of these, fifteen were at the drawbar and three on the belt. Classified differently, ten were tillage and eight were harvest operations. Table 2 shows in tabular form the performance of tractors on such operations as occurred with sufficient uniformity and frequency as to give value to the averages. The table indicates the more common types of tractor equipment, acreages covered, time required, and rates of per-

formance, but it by no means exhausts the possibilities for utilizing tractor power. In repeated operations, such as cultivating, the acreage shown is the area covered multiplied by the times over.

In addition to the operations shown in Table 2, tractor power was used for drilling grain on eleven plantations, grading and ditching on five plantations, raking hay on nine plantations, in connection with hay balers on twenty-two plantations, binding and combining on ten plantations, threshing on three plantations, dusting cotton and pulling hay loaders each oc-

DISKING WITH TRACTOR POWER

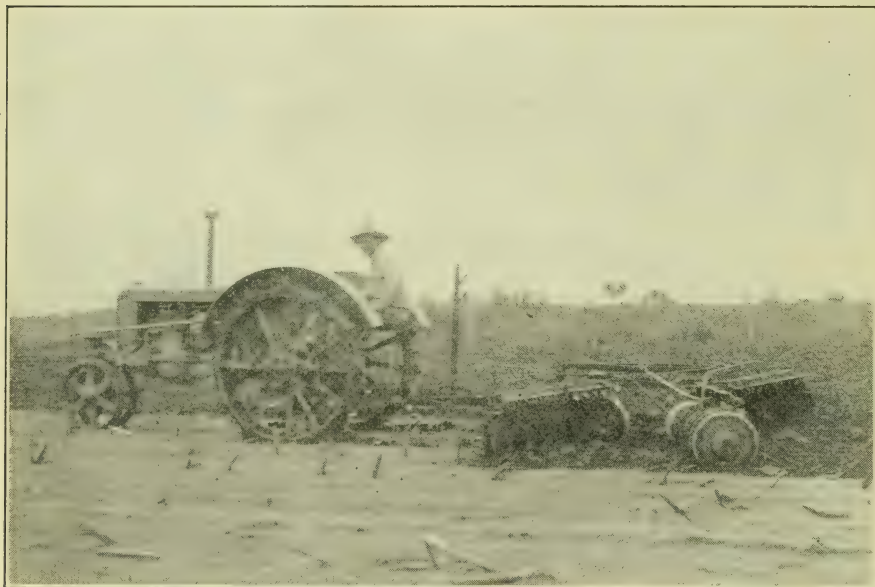


Fig. II—An 8-foot tandem disk, the type commonly associated with tractors. This machine often replaced the stalk cutter and the plow on farms owning tractors. The power unit is a 10-20 Case.

curred twice, and rotary hoeing, rolling land, hauling hay and cutting silage were each reported once. In the case of these latter operations the scarcity of observations, diversity of equipment, or both factors together rendered the average performance valueless, and individual performance may be misleading. However, one case may be discussed in order to emphasize an important principle in the economy of tractor operation.

Two plantations used tractor power for dusting cotton. Both used 10-20 general purpose tractors. One of the tractors was associated with dusting equipment designed especially for the tractor. It dusted at the rate of 44.4 acres per hour with a fuel and oil cost of eight-tenths of a cent per acre. The other tractor was associated with a duster originally designed for operation with mule power. Its rate was 2.0 acres per hour at a fuel and oil cost of 9.1 cents per acre. The former tractor was operated with gasoline at 19 cents per gallon and 45 cents per gallon was paid for the oil used. Cost of gasoline and oil per hour's operation was 37.8 cents. The latter tractor was started with 18 cent gasoline, operated on 12.5 cent kerosene and lubricated with 65 cent oil—fuel and oil cost per hour's operation was 22.2 cents.

A comparison of the above data suggests the importance of proper equipment as a means of obtaining maximum efficiency from a tractor. The kerosene burner had the lower fuel plus oil cost per hour, but because it was associated with obsolete equipment, its cost per acre of dusting was approximately 14 times that of the gasoline burner.

In this case efficiency was gained by employing dusting equipment designed especially for the tractor. Similar differences in efficiency might be observed where an attempt is made to use tractor power on planters, cultivators, disks and other equipment designed for operation with mules.

In this respect, attention may well be called to the advantages to be gained by operating a tractor at its full capacity. A certain amount of fuel, oil and labor are required to operate a tractor with no load at all which might be termed the necessary overhead expense of tractor operation. If then a full load consists of, let us say, a four-row implement, to operate the tractor on a two-row implement will result in a waste of half the overhead expense of operation.

Table 2. Tractor performance on various operations

Operation	No. of plantations	No. of Operations	Size and type of implement	Acres per tractor	Hours per tractor	Acres per tractor hour	Tractor hours per Acre
With general purpose tractors:							
Lat breaking	10	18	2-bottom disk plow	157.6	277.9	.6	1.8
Disking	30	73	6 ft. tandem disk	362.0	208.9	1.7	.5
Disking	7	22	7 ft. tandem disk	422.8	218.8	1.9	.5
Disking	6	14	8 ft. tandem disk	477.9	221.9	2.0	.5
Disking and harrowing	11	16	6 ft. tandem & 2 sec. har	144.9	88.9	1.6	.6
Drag harrowing	13	27	10 ft. drag harrow	266.1	109.3	2.4	.4
Bedding; 40" row	25	45	2-row middle buster	203.4	147.5	1.4	.7
Planting; 40" row	18	20	4-row planter	184.1	67.8	2.7	.4
Cultivating; 40" row	10	18	2-row cultivator	1186.0	658.1	1.8	.6
Cultivating; 40" row	18	28	4-row cultivator	1141.0	364.6	3.1	.3
Mowing	20	42	7 ft. mower	238.2	133.7	1.8	.6
With ordinary tractor:							
Disking	4	10	6 ft. tandem disk	231.0	127.7	1.8	.5
Disking	5	12	7 ft. tandem disk	403.8	236.8	1.7	.6

It is therefore important, where all responsibility for reducing costs is placed on the tractor, that it be associated with the most economical equipment, supplies and operating labor. In other words, to get the most from a tractor, it should be operated at its capacity by experienced labor, using the proper equipment, and the most economical grades of fuel and oil.

Fuel and Oil.

Fuel and oil taken together, constitute an important cost in tractor operation. This cost, together with the cost of operating labor varies directly with the time used. The kind of fuel used, size of tractor, speed, and amount of load also have marked influences on fuel and oil costs. Three kinds of fuel, gasoline, kerosene and fuel oil are usually interchangeable for modern tractors and the three fuel types were all encountered with more or less frequency. In order to arrive at an estimate of the relative economy of the different fuels, all tractors, regardless of size, type or age, were sorted on the basis of kind of fuel used, and the costs of fuel and oil per hour of operation were determined for the different fuels. All operations were included. These data are shown in Table 3. Tractors burning kerosene and fuel oil were started with gasoline, the amount and cost of which is included. The amount of gasoline used in starting kerosene and fuel oil burners averaged respectively .04 and .03 gallons per hour of operation.

The tractors in which gasoline was used were usually older than those burning the cheaper fuels. This may be accounted for by improvements in tractor design and the fact that higher test fuels are generally more satisfactory for use in the older models. The difference in "time used" between tractors burning gasoline and those burning cheaper fuels is because there

was a higher percentage of general purpose tractors in the latter groups which gave them a wider range of adaptation.

There was considerable variation in prices paid for lubricating oil and also in the amounts used, as some operators changed the oil much oftener than others.

Attention may be called to the uniformity in the quantity of the different fuels used per hour. From this, it is evident that savings in fuel cost depend upon the price of the fuel. This difference amounts to about 24 per cent in favor of kerosene or fuel oil.

MIDDLE BUSTING WITH TRACTOR



Fig. III—Middle busters constitute an important part of the tractor equipment. The 2-row size was most common, but a few 3-row outfits were encountered. The tractor drive wheels shown are of the older type. An improved type was being used on this and other makes of tractors. This power unit is a 10-20 Farmall.

Table 3. Fuel and oil costs per hour of tractor operation with different fuels

fuel	Different		Time used	Fuel per hour	Oil per hour	Costs		
	Tractors in group	operations performed				Fuel per hour	Oil per hour	Total
	Number	Number	Hours	Gallons	Quarts	Cents	Cents	Cents
Gasoline	37	16	582	1.73	.22	31.3	3.1	34.4
Kerosene	67	18	650	1.76	.31	21.9	4.4	26.3
Fuel oil	18	11	620	1.82	.28	22.0	4.0	26.0

NOTE: Average prices per gallon:- gasoline, 17.6 cents; kerosene, 12.3 cents; fuel oil, 12.0 cents; and lubricating oil, 56.5 cents.

Some of the tractor owners interviewed secured an exemption of the five cents per gallon gasoline tax. Individuals may order gasoline from sources outside the state without paying the tax where such gasoline is used strictly on their plantations, but no part of it can be legally used on the public highway without paying the tax. A number of plantation owning

groups have organized themselves into cooperative purchasing bodies for the purpose of securing tanks and equipment for the handling and distribution of fuel and oil for tractors.

The effect of speed and amount of load on the combined cost of fuel and oil per hour was determined by calculating these costs for 10-20 general purpose tractors using kerosene for the performance of selected operations. These were: plowing with 2-bottom disk gang plow, 32.1 cents; mowing with 7-foot mower, 30.6 cents; bedding with 2-row middle buster, 27.0 cents; disking with 6-foot tandem disk, 26.5 cents; harrowing with 12-foot section harrow, 24.2 cents. By multiplying these costs by the rates per hour shown in Table 2, an estimate of the fuel and oil cost per acre for the above operations may be obtained.

Table 4. Depreciation, interest and annual repair charges per tractor

Item	Unit	Groups based on ten hour days				All groups combined
		40.0 days and less	40.1 to 80.0 days	80.1 to 120 days	120.1 to 160.0 days	
Plantations reporting	No.	19	23	13	9	56
Tractors in group	No.	22	40	21	12	95
Average days used	No.	24.9	60.4	94.7	142.7	70.1
Average first cost	Dollar	861.59	936.50	954.85	854.17	912.81
Estimated life	Year					5.6
Charges:						
Depreciation*	Dollar	153.88	167.26	170.54	152.55	163.03
Interest**	Dollar	25.85	28.09	28.65	25.63	27.38
Annual repairs	Dollar	52.54	52.28	54.27	58.91	53.62
Total annual charge***	Dollar	232.27	247.63	253.46	237.09	244.03
Charge per 10-hr. day	Dollar	9.33	4.10	2.68	1.66	3.48
Charge per hour	Dollar	.93	.41	.27	.17	.35

* 17.86 per cent, based on average estimated life.

** Six per cent on one-half of first cost.

*** No charge has been made for housing.

Table 5. Summary of tractor operating costs per hour of operation for all tractors if kerosene is used as fuel

Item	When used annually:			
	24.9 days	60.4 days	94.7 days	142.7 days
	Cents	Cents	Cents	Cents
Fuel and oil from Table 3	26.3	26.3	26.3	26.3
Depreciation, interest & repairs from Table 4	93.3	41.0	26.8	16.6
Driver—based on 10-hr. day	20.8	20.8	20.8	20.8
Totals	140.4	88.1	73.9	63.7

Depreciation, interest on investment, and annual repairs are shown in Table 4. Since a uniform rate of depreciation—the average for all tractors—was used, this item varies with the first costs. This rate is used because it is thought that average estimates of all operators as to the tractors' periods of usefulness are more accurate than the estimates of a smaller group. The respective "estimated life" periods by groups beginning with "40.0 days and less" was 6.2, 5.0, 5.5 and 6.8 years. It is quite evident that the order in which these estimates occur is partly due to insufficient experience with tractors.

Interest on investment, likewise, varies with first cost since the rate used is uniform. Annual repair costs show a slight trend upward as the days of work increase. It was also noticed that annual repair costs increased as the tractor became older.

The sum of the three cost items shown in Table 4, the "Total annual charge" remains remarkably uniform for the several groups. It is when this item is divided by the days used that striking differences appear. It is imperative that the tractor be kept busy with optimum load if the minimum per hour cost is to be obtained.

Taxes are not included in Table 4 as a charge against tractors because of the common practice of including tractors with farm machinery on which there is a tax exemption to the valuation of two thousand dollars. A theoretical tax charge calculated at 40 mills on 60 per cent of the average first cost would increase the total annual charges for the several groups, beginning with that using tractors 40 days or less; to \$252.95, \$270.11, \$276.38, \$257.59 and \$265.94 respectively. The corresponding charges per hour would be: 1.02, .45, .29, .18 and .38 dollars.

Of the total time during which the 95 tractors were used, 90.5 per cent was on the drawbar and 9.5 per cent was at the belt. Only 1.2 per cent of the total time was reported as "custom" work, the remainder being spent on the owner's own work. The undertaking of custom work by those who find it difficult to keep the tractor reasonably busy on their own operations, is suggested as a means of reducing the unit costs of operation.

The daily wage rate for 112 hired tractor drivers was obtained. This ranged from \$1.25 to \$3.00 with an average of \$2.08 per day. An average of 38 minutes per day per tractor was spent on fueling, oiling, greasing and other preparation for tractor operation. Cost of driver is included in Table 5.

Had gasoline been used in computing Table 5, the per hour costs would have been 8.1 cents greater in each case.

No trade-in or resale value has been allowed since such disposal was not generally practiced.

TRUCKS

Age and History.

Fifty of the plantation owners interviewed owned a total of 62 trucks. Some of these trucks were used very little for hauling on the road or were used more in the capacity of an automobile and therefore are not included in all tabulations. Since trucks may be used in the city as well as in the country, they were developed earlier than the farm tractor. The first truck purchased of which a record was obtained was bought in 1916 and was used eight years; quite different from the first tractors recorded which were discarded after two years of rather unsatisfactory service.

The earlier plantation owned trucks were often poorly adapted to the needs. Many were too large and expensive and the solid tires with which they were equipped were ill-adapted to wet dirt roads. With the advent of hard surfaced roads and pneumatic tires together with a greater variety of sizes and designs, the use of plantation trucks has shown a distinct upward trend.

Capacities of from one to two tons predominated on the plantations studied, although some owners reported having owned trucks of as high as six tons capacity. On six plantations, trailers were used for hauling in connection with the trucks.

Such trailers were considered as integral parts of the trucks in this report. Their capacities were: one 2.5 T., two 3 T., two 4 T., and one 6 T.

The fifty owners interviewed reported on the disposal of thirteen out of thirty trucks which had been owned at one time. The observations were too few in number to give dependability to the data. It was observed, however, that selling or trading was the general method of disposal. Very few trucks were summarily junked.

Range of Usefulness.

Because of the differences in type of commodities hauled, distance of haul and duration of terminal stops, the data were tabulated on the basis of ton miles for each commodity hauled. Only road hauling to and from the

plantation was considered. Because of the great variability existing in the size of the loads, distances, and stops, hauling on the plantation was not included in total yearly ton miles. Short stretches of dirt roads were recorded, but the mileage of such was so small that for practical purposes all hauling may be considered as over graveled or paved roads.

Fifty-five of the 62 trucks owned on 50 plantations were used for road hauling. Seven trucks owned were not used on the road, and since mileage and tonnage data appeared inadequate, they were excluded from the tabulations. Hauls, both to and from the plantation were included. Seed cotton was hauled from the plantation in all cases. Cotton seed and cotton lint were hauled both ways by different planters and occasionally by the same planter. Grain feed was ordinarily hauled to the plantation, while a few market hay producers hauled their product from the plantation. Fertilizer was in all cases hauled to the plantation. Families were hauled to the plantation, while laborers were hauled both to and from the plantation. Miscellaneous commodities were hauled both ways by different planters.

Some commodities were never weighed. In fact, they were commodities which are not ordinarily considered in units of weight. For these the weight was estimated in order to place them on a comparative basis. All grain feed was converted to tons. Families, or rather the household goods pertaining to a family, were estimated at one ton per family. Laborers were estimated at 15 to the ton. Lumber and wood which made up a large part of the miscellaneous hauling were converted to tons on the basis of various estimates of planters.

Attention should be called to the data for hauling families and labor, which when compared to those for other commodities, appear to be out of line. This appearance is due to long hauls made. Families were not infrequently moved from a distance of 25 or 30 miles. Cotton pickers were, in a

PLANTING AND FERTILIZING



Fig. IV.—The most common size of tractor planter was the 4-row. The same equipment was sometimes used to distribute fertilizer with a separate operation, but planters of a number of makes are available with attachments to distribute fertilizer simultaneously with planting. This is a John Deere outfit.

number of cases, brought from as far as 20 miles and returned daily. Several trips were made to southern Texas and several to southern Mississippi to bring in and return cotton pickers.

The data of Table 6 show the influence of bulkiness of product on size of load, the influence of haul and terminal wait on the used time, and other data of a similar nature. These data are brought together in more compact form in Table 7. Here it can be seen that the basis on which a truck's services are distributed will cause the proportions of such service to vary greatly among the commodities served.

Table 6. Truck hauling on road; commodities, amounts, rates, and miscellaneous data

Item	Unit	Kind of commodity				
		Seed cotton	Cotton seed	Cotton lint	Grain feed	Hay and roughage
Plantations reporting operation	No.	31	18	15	19	18
Trucks reported being used	No.	35	21	17	20	19
Average:						
Amount hauled per plantation	Ton	155.9	234.2	160.4	45.5	99.4
Amount hauled per truck	Ton	138.1	200.7	141.5	43.2	94.2
Ton miles per plantation	T.M.	959.3	2239.5	936.5	242.3	588.7
Ton miles per truck	T.M.	849.7	1519.6	826.3	230.2	557.7
Amount hauled per load	Lb.	2371	4286	3576	2285	3260
Hours per truck	Hour	406.4	167.0	173.0	50.5	112.3
Mileage per truck*	Mile	1151.5	968.0	642.0	202.6	501.7

Table 6—continued

Item	Unit	Kind of commodity			
		Fertilizer	Families and labor	Miscellaneous	Total—all commodities
Plantations reporting operation	No.	28	45	32	50
Trucks reported being used	No.	31	45	35	55
Average					
Amount hauled per plantation	Ton	36.2	30.4	47.9	360.4
Amount hauled per truck	Ton	32.7	30.4	43.8	327.6
Ton miles per plantation	T.M.	142.2	818.9	338.5	2771.2
Ton miles per truck	T.M.	128.4	818.9	309.5	2519.3
Amount hauled per load	Lb.	3565	2326	2127	2794
Hours per truck	Hour	30.7	122.0	127.0	631.3
Mileage per truck*	Mile	142.7	1091.8	657.0	2940.0

* Total mileage on operation.

NOTE: For the 55 trucks reported used, the average mileage per gallon of gasoline was 9.92 and per quart of oil, 30.24.

Table 7. Trucks; distribution of services to different commodities on different bases

Commodity hauled	Based on:				
	Hours used	Mileage	Tonnage	Gas consumption	Ton miles
	per cent	per cent	per cent	per cent	per cent
Seed cotton	40.98	24.93	26.82	24.86	21.46
Cotton seed	10.11	12.58	23.40	12.44	23.03
Cotton lint	8.46	6.75	13.35	6.80	7.25
Grain feed	2.91	2.51	4.79	2.35	3.32
Hay and roughage	6.15	5.89	9.93	5.19	7.65
Fertilizer	2.74	2.74	5.63	2.92	2.87
Families and labor	15.82	30.38	7.58	30.14	26.60
Miscellaneous	12.83	14.22	8.50	15.30	7.82
Tota's	100.00	100.00	100.00	100.00	100.00

It can thus be seen at a glance, for example, that hauling cotton seed as compared with hauling seed cotton required one-fourth as much time and about one-half as many miles and gallons of gasoline, while the tonnage of seed moved amounted to over 87 per cent of the seed cotton tonnage. On the basis of the ton mile, cotton seed required a slightly higher percentage of the truck's service than seed cotton. The hour basis gives undue prominence to light loads and long terminal waits peculiar to, but often necessary for, hauling seed cotton. With the mileage basis, long trips wield an undue influence as in the case of moving families and hauling labor. The short haul and heavy load are emphasized by the tonnage basis, while the gasoline consumption basis is quite similar in its workings to that of mileage.

The ton mile is a computed figure used as the unit of weight moved. It is arrived at by multiplying the weight by the distance moved, and therefore gives due consideration to both mileage and tonnage, but takes no account of terminal waits. The latter is perhaps of little importance for this study, since interest, depreciation and taxes are calculated on a full year basis and depreciation would be but slightly, if any, greater while waiting at a terminal than it would be while standing idle at its base. Gasoline consumption would no doubt vary directly with ton miles if recorded by actual experiment using a road of fixed surface and grade and stopping the motor while the truck was at rest.

The estimates used in this report of gasoline and oil consumption perhaps have an upward bias for hauling bulky commodities and a downward bias for the dense commodities. It was observed that those reporting usually gave the same mileage per gallon and per quart estimate whether hauling an 1800 pound load of seed cotton or a 3000 pound load of fertilizer, with road surface and grade similar.

Everything considered, it is evident that the ton mile basis, while not all-inclusive, is yet the most accurate basis determined from this study for distributing truck services. It will therefore be used where such a figure is desirable in estimating costs of truck ownership and operation.

The amount of road hauling by different truck owners varies between wide limits. Of 42 trucks which were purchased new and used the greater part of the year, this use ranged from 93 to 7801 ton miles. Data pertain-

CULTIVATING SMALL COTTON



Fig. V—Four-row sizes predominated among tractor cultivating equipment. From the first to the last cultivation, they were reported as being equally efficient. Several makes are on the market; this one is a Case.

ing to 36 of these trucks which fell into convenient groups are shown in Tables 8 and 9.

From Table 8, it may be seen that the percentage of trucks operated with trailers increases with an increase in ton miles hauled. The percentages of trucks with trailers in the three groups are 5.5, 23.1, and 40.0, which probably accounts for the differences in the average first cost since trailers are included as integral parts of the trucks. One would expect the estimated period of use to vary downward with the amount of use. This would probably be shown if the total use of the trucks were taken into consideration, but since only road hauling is shown here, the estimated use periods in the three groups appear somewhat contrary to expectations.

The fact that costs for licenses and annual repairs are slightly less in the third group than in the second may be attributed to the small number of observations in the former group and differences in the size of trucks. Ton miles, miles on road and hours on road fall naturally in an upward trend since the grouping was made on the basis of ton miles hauled.

In the use of gasoline and oil the three groups were about equally efficient. Mileage per gallon of gasoline averaged 10.8, 10.7, 9.9 and 10.5 miles respectively for the three groups and the groups combined. Mileage per quart of lubricating oil in the same order was 31, 29, 41 and 32; while ton miles per gallon of gasoline was 5.55, 6.68, and 6.66 and 6.39. Daily chore time is included in the table for any interest that it may contain.

Four trucks hauled over 7,000 ton miles each during the year with an average of 7,577 ton miles. All were operated with trailers. It appears that the use of trailers is increasing, especially where there is much road hauling to be done.

From the data shown in Table 8, an estimate of the costs per ton mile of truck hauling may be made by applying prices to gasoline and oil consumption, estimating taxes and adding driver wages. This has been done in Table 9.

Interest charge was based on 6 per cent of one-half of the original cost of the truck. Depreciation is based on the average period of usefulness for all trucks. It should be said here that no allowance for trade-in value has been made since no such figure was available. Any amount received when the truck is disposed of will serve to lower the ton mile cost of truck hauling. Taxes as shown are only an estimate. They will vary widely with the district in which the owner lives. Costs for licenses and annual repairs need no further explanation.

In calculating ton mile costs of road hauling, it has been assumed that such hauling constituted 75 per cent of the annual service of the truck.

Table 8. Trucks: first cost, estimated period of use, cost of repairs, license, and use data

Item	Unit	Groups hauling different amounts:			
		Hauling less than 1500 ton miles	Hauling 1501 to 3000 ton miles	Hauling 3001 to 4500 ton miles	All trucks
Total trucks in group	Number	18	13	5	36
Trucks with trailer included	Number	1	3	2	6
Average per truck:					
First cost	Dollar	718	930	956	827
Estimated period of use	Year				5.3
Annual cost of repairs	Dollar	64.38	133.92	122.00	97.78
Cost of license	Dollar	14.77	20.86	20.24	17.73
Ton miles hauled annually	T.M.	755	2225	3834	1713
Miles on road annually	Mile	1462	3570	5716	2814
Hours on road annually	Hour	495.4	708.5	1143.0	662.6
Gasoline consumed	Gallon	136	333	576	268
Lubricating oil consumed	Gallon	11.9	30.3	34.5	21.7
Daily chore time	Minute				22

Table 9. Trucks: estimated annual fixed costs and costs per ton mile of road hauling

Item	Groups hauling different amounts:			
	Hauling less than 1500 ton miles	Hauling 1501 to 3000 ton miles	Hauling 3001 to 4500 ton miles	All trucks
	Dollars	Dollars	Dollars	Dollars
Interest—6% on half of first cost	21.54	27.90	28.68	24.81
Depreciation—18.87%, based on average period of use	135.49	175.49	180.40	156.30
Taxes—40 mills on 60% of half of first cost	8.02	11.16	11.47	9.92
License—from Table 8	14.77	20.86	20.24	17.73
Annual repairs—from Table 8	64.38	133.92	122.00	97.78
Total fixed charges	248.20	369.33	362.79	306.54
Assumed 75% chargeable to road hauling	186.15	277.00	272.09	229.90
Gasoline—from Table 8 @ 18½c	25.16	61.60	106.56	49.58
Lubricating oil—from Table 8 @ 74c	8.81	22.42	25.53	16.02
Wages of driver @ 18.6c per hour*	92.14	131.78	212.60	123.24
Total road hauling charges	312.26	492.80	616.78	418.74
Ton miles hauled—from Table 8	775	2225	6834	1713
Cost per ton mile	.40	.21	.16	.24

* Based on average daily wages of 57 hired drivers and 10-hour day.

This is an arbitrary assumption since a complete record of hauling on the plantation was not obtained. It may be unfair to one or more of the groups shown because the more a truck was used on the road, the less it was used on the plantation. If the latter assumption should be correct, the ton mile costs as shown would be materially different. Gasoline and oil costs are sufficiently clear. Drivers' wages are charged in at the average daily wage of 57 hired truck drivers, the wages of which were reported. With some commodities, additional labor was employed in loading and unloading of which no record was obtained.

The value of Tables 8 and 9 lies partly in supplying a form by which individual hauling costs may be estimated. The individual truck owner, by substituting data from his own truck hauling operations for that shown in Tables 8 and 9, should be able to estimate his individual costs with considerable accuracy.

MULES

Range of Usefulness.

Unlike tractors and trucks, mules may be used either for work on the plantation or for hauling on the road and in varying sized power units. With one mule, a small garden may be worked or with additional mules, a power unit equal to that of the largest farm tractor may be obtained. In this study, however, only one plantation reported using teams larger than four mules. This plantation reported the occasional use of five-mule teams.

Table 10 shows the rates of performing those plantation operations with different machines and power units as occurred with sufficient frequency to justify the use of an average. The more common types and sizes of implements with associated power unit for the different operations may be readily seen. It may also be noted that in disking with a 4-mule team, ground is covered considerably faster with the 5- to 6-foot disks than with the 3.5- to 4-foot implements. On the other hand, bedding with 2-furrow, 7- and 8-inch plows is performed at the same rate with 1- and 2-mule teams; and that there is only a slight difference in the rate of covering ground with 2- and 4-mule teams when bedding with middle busters. In the two latter cases, quality of work is a factor which was not taken into account.

On the planting, tilling and harvesting practices, which are ordinarily operations requiring less power than land preparation, the larger power units on larger implements show a definite saving of time.

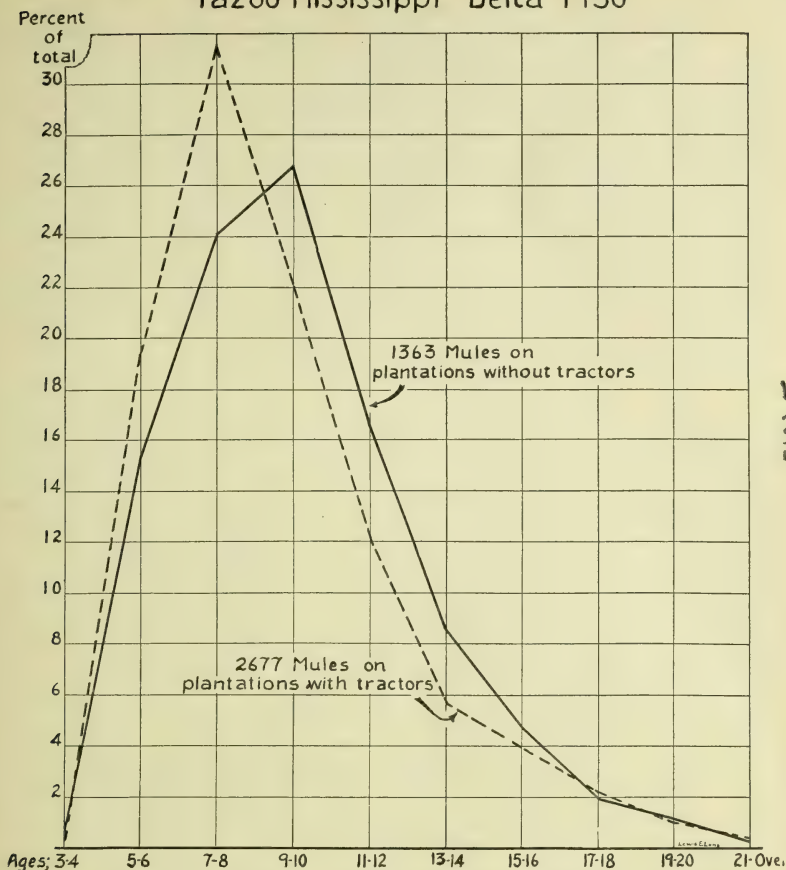
In addition to the operations shown in Table 10, there were scattering reports of 4-mule teams for cultipacking, rotary hoeing, plowing, drag harrowing, drilling grain, cultivating, and binding grain; 3-mule teams for stalk cutting, disking, plowing, bedding with middle buster, drilling grain, cultivating, dusting cotton and binding; 2- and 1-mule teams for dusting cotton. In many cases, several team sizes were used for the same operation on a plantation. It was not unusual to find 1- and 2-row planters or one-half and 1-row cultivators being operated in the same field.

It is quite evident that teams of a particular size are preponderantly peculiar to certain operations. This is perhaps due largely to the results of experience, but to some extent, no doubt, to custom. Customs become established through the results of applying particular methods to certain conditions. Once established, they hang on tenaciously even after the conditions on which they were based are greatly changed or no longer exist. It is advisable, therefore, to take stock occasionally in order to determine the advisability of continuing in the customary manner, or changing to more desirable methods because changed conditions may have rendered the old way obsolete.

Table 10. Mule performance on various operations

Operation for different crops	Number of reports	Size and type of implements	Mules per team	Total acres	Acres per team hour.	Team hours per acre
Cutting stalks	36	1-row stalk cutter	2	26259	.83	1.2
Disking	8	3.5 & 4 ft. single disks	4	1925	.68	1.5
Disking	8	5 & 6 ft. single disks	4	1508	.92	1.1
Flat breaking	29	7 & 8 inch plows	2	7283	.17	5.7
Streaking off:						
36 to 42 inch rows	8	Single shovel	1	3752	.64	1.6
Bedding: 2 furrows—						
36 to 42 inch rows	9	7 & 8 inch plows	1	7640	.38	2.6
36 to 42 inch rows	50	7 & 8 inch plows	2	28514	.38	2.6
Bedding: with middle buster—						
36 to 42 inch rows	65	10 & 12 inch busters	2	60197	.66	1.5
36 to 42 inch rows	41	14 & 16 inch busters	4	32803	.62	1.6
Harrowing:						
Broadcast	37	7 & 8 ft. drag harrows	2	26836	1.18	.8
Broadcast	14	9 & 10 ft. drag harrows	3	13261	1.47	.7
On beds	36	Various har. implements	1	19135	.68	1.5
Distributing fertilizer:						
36 to 42 inch rows	62	1-row distributor	1	39638	.63	1.6
Planting:						
36 to 42 inch rows	81	1-row planter	1	59663	.64	1.6
36 to 42 inch rows	21	2-row planter	2	4457	1.30	.8
Cultivating middles:						
Once to mid; 36 to 42"	38	1-mule cultivator	1	100961	.53	1.9
Twice to mid; 36 to 42"	66	1-mule cultivator	1	320667	.29	3.4
Cultivating rows:						
36 to 42 inch rows	55	2-mule cultivator	2	165120	.62	1.6
Drilling grains:	21	6, 7 & 8 ft. drill's	2	1349	1.03	1.0
Mowing:						
Various crops	27	4.5 ft. mower	2	2852	.66	1.5
Various crops	32	5 ft. mower	2	4240	.70	1.4
Raking:						
Various crops	18	8 ft. dump rake	2	1274	1.26	.8
Various crops	47	10 ft. dump rake	2	7328	1.43	.7
Various crops	12	Side delivery rake	2	7205	1.25	.8

DISTRIBUTION OF MULE AGES Yazoo-Mississippi Delta 1930



1363
 2677
 4040

Fig. VI. Eight-year-olds constituted the largest age group on both tractor and non-tractor plantations. On tractor plantations, .3% of the mules were under 5 years old, 85.1% were from 5 to 12 years old and 14.5% were over 12. Corresponding percentages for non-tractor plantations were .6, 82.9 & 16.4.

Two plantation reports were obtained which showed that no field work was performed with mules. The total number of mules on the two plantations, which were of medium size, was eight head. One plantation with six mules, used them for odd jobs, while the other rented its two mules out to a neighbor.

Seventy-four plantations used mules more or less for road hauling, Table 11. Commodities hauled were the same as those for trucks with the exception of miscellaneous items. The proportionate quantities of the different commodities differed, however, from those hauled by trucks. Only one plantation reported road hauling of cotton seed with mules and only a few used mules on the road for hauling families and labor. Practically all fuel was hauled by mules. This consisted principally of wood hauled from the forests.

Fuel ranked first in tonnage hauled while seed cotton ranked first in ton miles of hauling. Cotton lint made up the largest average loads, followed by fertilizer.

Table 11. Mule hauling on road; commodities, amounts, rates and miscellaneous data

Item	Unit	Kind of commodity				
		Seed cotton	Cotton seed	Cotton lint	Grain feed	Hay and roughage
Plantations reporting operation	No.	74	1	4	21	9
Two-mule teams reported*	No.	532	4	10	79	32
Average:						
Wagons used per plantation	No.	7.2	4.0	2.5	3.8	3.5
Amount hauled per plantation	Ton	437	20	124	43	28
Amount hauled per team	Ton	55.8	5.0	49.8	11.6	7.9
Ton miles per plantation	T.M.	1094	240	144	98	123
Ton miles per team	T.M.	152.2	60.0	57.7	25.9	34.7
Amount hauled per load	Pound	1910	2000	2750	1856	2028
Mule hours per plantation	M.H.	6242	440	376	339	283

Table 11—continued

Item	Unit	Kind of commodity			Total or average All commodities
		Fertilizer	Families and labor	Fuel	
Plantations reporting operation	No.	29	7	22	74
Two-mule teams reported*	No.	120	15	209	532
Average:					
Wagons used per plantation	No.	4.1	2.1	7.5	7.2
Amount hauled per plantation	Ton	37	4	488	619.7
Amount hauled per team	Ton	9	1.8	51.3	86.2
Ton miles per plantation	T.M.	89	31	749	1408
Ton miles per team	T.M.	21.6	14.6	78.8	195.9
Amount hauled per load	Pound	2437	867	1649	1929
Mule hours per plantation	M.H.	259	199	6274	8385

* Modal size: 2-mule.

Feed constitutes the largest item entering into the cost of mule work.

Table 12 shows the amounts of feed fed to mules on 88 plantations together with the value of feeds as estimated by the planters and the calculated annual cost of feed. The records were sorted according to whether a truck, tractor, or both, was kept in addition to mules.

Plantations where mules only were kept, had the heaviest mules on the average, while those having trucks, but no tractor, had the lightest. The former is perhaps to be expected since heavier mules would be needed where one does not have a tractor for heavy jobs. The fact that the mules on the plantations where trucks are owned were the lightest is perhaps a coincidence.

Plantations having tractors fed more alfalfa and less soybean hay per mule than those without tractors. Both of these crops thrive in the area, but soybeans have a somewhat wider adaptation to soils which may account for their slight predominance. Amounts of roughage fed per mule were fairly uniform, but on the basis of amount per 1000 pounds live weight, plantations having mules only fed less roughage, but utilized more pasture than others. This was also true in regard to grain feed. In this case, plantations with mules only fed less grain per mule although they had the largest mules. Cottonseed meal is not commonly fed to mules, the practice being found on only a few plantations. It could be fed to mules more generally if found to be economically desirable.

Values for the different feeds are averages of the estimates of the entire group of operators. Very little pasture was utilized so that the quantity and money costs may be considered as for dry lot feeding for practical purposes.

Plantations having mules only had the lowest feed costs per mule. These were followed by those having mules and tractors, but no trucks, while

Table 12. Mule feed; kinds, amounts and values

Item	Unit	Plantation groups				
		With mules, tractors and trucks	With mules and tractors	With mules and trucks	With mules only	All Planta- tions
Plantations in group	No.	36	24	11	17	88
Average:						
Mules per plantation	No.	49	51	34	47	47
Weight per mule	Pound	1058	1081	1034	1172	1084
Alfalfa per mule*	Ton	1.13	1.05	.50	.72	.97
Soybean hay per mule	Ton	.97	.96	1.07	1.31	1.04
Sorghum hay per mule**	Ton	.43	.16	.54	.36	.35
Oat hay per mule	Ton	.03				.01
Other hay per mule	Ton	.29	.59	.50	.36	.41
Total roughage per mule	Ton	2.85	2.76	2.61	2.75	2.78
Corn per mule	Bu.	65	65	73	60	65
Oats per mule	Bu.	12	3	7	13	9
Sweet feed per mule	Ton	.16	.09	.19	.06	.13
Cottonseed meal per mule	Pound		2		5	3
Total concentrates per mule	Pound	4358	3876	4688	3894	4157
Value of roughage per mule	Dol.	60.61	60.36	53.03	57.79	59.25
Value of concentrates per mule	Dol.	85.36	76.45	92.35	75.88	82.12
Value of pasture per mule	Dol.	.81	1.35	2.01	2.09	1.45
Total val. of feed per M.	Dol.	146.78	138.16	147.39	135.76	142.82
Feed per 1000 lbs. live weight:						
Roughage	Ton	2.66	2.54	2.52	2.35	2.56
Concentrates	Pound	4120	3585	4534	3321	3333
Value of feed and pasture	Dol.	137.36	129.79	147.29	114.85	131.29

* Average feed value per unit were: alfalfa, \$24.23; soybean hay, \$20.98; sorghum hay, \$14.65; oat hay, \$15.20; other hay, \$21.09; corn, \$1.08; oats, \$.62; sweet feed, \$48.25; and cottonseed meal, 2.4 cents.

** Includes sagrain.

Table 13. Mules; interest, depreciation, taxes, and miscellaneous expense

Item	Unit	Plantation groups				
		With mules, tractors and trucks	With mules and tractors	With mules and trucks	With mules only	All plantations
Plantations in group	No.	36	24	11	17	88
Mules in group	Head	1772	1232	374	797	4175
Average per mule:						
Value	Dol.	111.96	117.96	92.58	113.81	112.35
Hostler labor	Hour	52	45	48	36	47
Annual expense:						
Interest at 6%	Dol.	6.72	7.08	5.55	6.83	6.74
Depreciation at 12.5%	Dol.	14.00	14.74	11.57	14.23	14.04
Taxes*	Dol.	2.69	2.83	2.22	2.73	2.70
Veterinary and shoeing	Dol.	2.58	1.59	2.17	1.58	2.05
Hostler @ 10c per hour	Dol.	5.20	4.50	4.80	3.60	4.70
New harness and repairs	Dol.	3.94	2.60	2.97	3.72	3.41
Total above items	Dol.	35.13	33.34	29.23	32.69	33.64

* Estimated at 40 mills on 60 per cent valuation.

plantations with mules and trucks but no tractors had the highest feed cost per mule of the four groups.

Many plantation operators have materially reduced their mule feeding cost by growing sagrain which may be cut and fed green, pastured in the fall and winter, or cut and cured, in which case it makes a fair grade of fodder and good yield of grain similar to corn in feeding value. Soybeans are also extensively grown for hay or pasture. As hay, soybeans are similar to alfalfa when cut at the proper stage and carefully handled. They make excellent fall and early winter pasture and, for this purpose, may be planted with corn or sagrain. Alfalfa may also be economically produced on many

FLAT BREAKING WITH MULES



Fig. VII—Two-bottom gang plow, operated with five animals. Twelve could be handled as easily. Practically any size mechanical power unit can be duplicated with mules where one has room to operate. Plans of hitches may be obtained from the Horse Association of America.

plantations. These crops are ordinarily produced with wage hands, and often with mechanical power.

For those desiring information on feeding mules, Bulletins 244 and 270, "Mule Feeding Experiments," may be obtained free by writing the Experiment Station, A. & M. College. Information pertaining to production of sa-grain, soybeans and alfalfa may be had from W. E. Ayres, Director, Delta Branch Station, Stoneville, Mississippi.

Interest, depreciation, taxes and miscellaneous expenses of keeping mules are shown in Table 13. Depreciation is based on a useful period of eight years with no resale value allowed. The average present value was used in arriving at both interest and depreciation costs. Shoeing and veterinary expense are as estimated by the operators as is also the expense of equipping the animals for work. The amount of hostler labor together with the wages paid was obtained. Since this labor was in addition to the chore labor performed by field hands, it is included as a charge against the mules. No record was obtained of building and fencing charges although interest, depreciation, taxes, upkeep and insurance on stables logically constitute a charge against work animals, though a small one. On the other hand, no credit has been allowed for manure values. The amount hauled out, according to the estimates of the plantation operators, averaged 132 tons per plantation or 2.8 tons per mule annually.

Table 14. Mules; hours worked, total costs and costs per hour of work

Item	Unit	Plantation groups				
		With mules, tractors and trucks	With mules and tractors	With mules and trucks	With mules only	All plantations
Plantations in group	No.	36	24	11	17	88
Mules in group	Head	1772	1232	374	797	4175
Average per mule:						
Weight	Pound	1058	1081	1034	1172	1084
Work-field operations	Hour	740	1172	943	844	927
Hauling on road	Hour	93	154	120	219	137
Hauling on plantation	Hour	271	293	301	117	224
Total work annual'y	Hour	1104	1529	1364	1180	1288
Value of all feed	Dol.	146.78	138.16	147.39	135.76	142.82
Other costs	Dol.	35.13	33.34	29.28	32.69	33.64
Total annual costs	Dol.	181.91	171.50	176.67	168.45	176.46
Cost per hour of work	Cent	16.5	11.2	13.0	14.3	13.7

The several types of work done with mules, and the several cost items are brought together in Table 14, and the cost per hour of mule work calculated. The results here show plainly that a low feed cost is not the only thing to be considered in keeping mules. In fact, it is just half the real consideration, since mules must eat even when idle. The feed cost in relation to the amount of work done is the more important. Although the group with mules only had the lowest feed cost, two groups did more work per mule and had lower costs per hour of mule work. While the group with mules only used more hours per mule for road hauling than any other group, they had less plantation hauling per mule than any other, and only one group did less field work per mule.

Using the mule costs per hour of Table 14, estimated wagon use cost and driver wages, the cost per ton mile of road hauling with mules is calculated in Table 15. The driver and wagon were included in order to make the result comparable to the ton mile costs of hauling with trucks as shown in Table 9.

Table 15. Mules: costs per ton mi'e of road hauling

Item	Unit	Plantation groups				
		With mules, tractors and trucks	With mules and tractors	With mules and trucks	With mules only	All plantations
Costs per group:						
Mule work	Dol.	27191.34	21249.54	5834.40	24959.65	78360.58
Estimated cost for wag.	Dol.	882.74	1121.19	225.06	873.28	3102.27
Driver (1 per two mules) at 10c per hour	Dol.	8239.80	9486.40	2244.00	8727.15	28598.75
Total cost	Dol.	36313.88	31857.13	8303.46	34560.08	110061.60
Hauling per group	Ton mi.	26942	32462	9807	25280	94491
Average cost per ton mile	Dol.	1.35	.98	.85	1.37	1.16

Cost per ton mile of hauling with mules is seen to be several times that of hauling with trucks. As calculated, the costs of hauling with mules are dependent upon a number of factors, of which cost per hour of mule work, size of load, and length of haul are perhaps most important. The effects which ownership of tractors and trucks may have on costs of mule hauling are only such as may be reflected through differences in the per hour costs of mule work. Where the 88 plantations were sorted into two groups, those owning trucks and those without trucks, the average cost per ton mile of road hauling with mules was \$1.21 and \$1.15 respectively. Since the speed of mules on the road is slow as compared with that of trucks and mules require rest periods at intervals, they are not adapted to long hauls or long continued periods of use, two factors which materially influenced the cost of hauling with trucks. Ton mile costs of hauling with mules are susceptible to wide variations, but such costs are ordinarily lowest where the cost per hour of mule work is low and the haul is short.

DITCHING WET "BUCKSHOT" LAND



Fig. VIII—Eight-mule team with multiple hitch, drawing a Corsicana ditching machine. Knowledge of how, and ability to use teams of this size and larger should be found on every plantation operated with mule power.

As a further measure of the efficiency with which mules were handled by the different groups, the acres of crops per mule were obtained. These are shown in Table 16. Inspection of the figures in this table leads to one of two possible conclusions. Either the planters owning tractors and trucks are not making full use of them or they are not getting the maximum amount of work from their mules. Only one group, that having both tractors and trucks, handled more crop acreage per mule than the group with mules only and here the difference was only 2.7 acres or about 14.5 per cent of the acreage handled per mule on the "mule only" plantations. Of course, there is the question of quality of work of which we have no record except as it may be indicated by a comparison of yields which will be made later. It is probable that many tractor and truck owners have made the common mistake of retaining the usual number of mules after purchasing the mechanical power units and allowing a part or all of these mules to remain idle while mechanical power is in use. Since such costs as interest, depreciation and taxes go on whether a power unit is used or not, economy lies in making the greatest possible use of such units whether animal or mechanical. Maximum economy of truck or tractor operation can be obtained only when these machines actually replace mules or when the operations are sufficiently expanded to utilize the added power to its full capacity.

Table 16. Mules: total hours worked and acreages of crops per mule

Item	Unit	Plantation groups				
		With mules, tractors and trucks	With mules and tractors	With mules and trucks	With mules only	All plantations
Mules in group	Head	1772	1232	374	797	4175
Work per mule annually	Hour	1104	1529	1364	1180	1288
Weighted average:						
Cotton per mule	Acre	15.9	13.7	13.2	14.4	14.7
Corn per mule	Acre	3.0	3.2	3.2	3.1	3.1
Other crops per mule	Acre	2.4	1.4	1.4	1.1	1.8
All crops per mule	Acre	21.3	18.3	17.8	18.6	19.6

COMPARISON OF TRACTOR AND MULE POWER FOR FARM OPERATIONS

In comparing the relative costs of performing the several farm operations with tractor and mule power, only the power unit and the driver will be considered. To make the mule operations comparable with the tractor operations, a driver will be included at 10 cents per hour. It is recognized that overhead costs are greater per unit on tractor drawn equipment than on that drawn by mules, but since costs on the latter can hardly be estimated and since the former are capable of handling a larger acreage, they will be left out of the consideration. It is probable that if a comparison of equipment were made on the basis of overhead costs per unit of work which the machine was capable of doing, the difference would not be great.

These comparative costs are shown in Table 17. The costs are calculated by applying costs per hour to performance records as shown in Tables 2 and 10. Tractor hour cost is the average of the four groups, Table 5, and mule hour cost is that for all mules, Table 14, with one man per team included at 10 cents per hour.

In making such comparisons, the quality of work is important. Tractor implements were: disk gang plow, 6-foot tandem disk, 10-foot drag harrow, 2-row middle buster, 4-row planter, 4-row cultivator and 7-foot mower. Four-mule implements were: 5- and 6-foot single disks and 14- and 16-inch

middle busters. Three-mule harrows were 9 and 10 feet in width. Two-mule implements consisted of 7- and 8-inch moldboard plows, 7- and 8-foot harrows, 10- and 12-inch middle busters, 2-row planters, 1-row cultivators, and 5-foot mowers. Implements operated with one mule were various implements to harrow off beds, 1-row planters and half-row cultivators.

The economy of tractors is clearly shown for those operations which utilize most of the available power, such as flat breaking and disking. On the other hand, the difference in cost of harrowing with a tractor and 10-foot harrow and with two mules and 7- or 8-foot harrow is in favor of mules, because the tractor was used at approximately half of its maximum efficiency. Per acre cost of harrowing with three mules was greater than that with two mules probably because the three-mule teams could have drawn a

Table 17. Average costs of power per acre for performing certain operations with different power units

Operation	Unit	Power units				
		General purpose tractor	4 mules	3 mules	2 mules	1 mule
Flat breaking	Cent	147.4			213.2	
Disking	Cent	40.9	71.3			
Drag harrowing	Cent	32.8		35.8	29.9	35.5
Bedding with middle buster	Cent	57.3	103.7		56.1	
Planting	Cent	32.8			29.9	37.9
Cultivating	Cent	24.6			59.8	80.6
Mowing	Cent	49.1			52.4	

larger implement. The quality of work in bedding with middle busters may vary widely even with implements of the same size since depth of busting is an important factor. This probably accounts for the differences in cost between 4- and 2-mule busters. Planting being a light draft operation, differences in costs as among the several power units shown are not great.

Cultivating costs per acre vary upward from the tractor to the 1-mule team. It is of interest to note, however, that where a 2-row cultivator was used with the tractor as was the case on a number of plantations, the cost per acre was doubled, amounting to 49.2 cents, another case of failing to utilize the available power.

Where the cost of the driver is included in power costs for mules as in Table 17, the smaller the team the larger the percentage which the driver cost is of the total. Thus, with a 4-mule team, mule work at 13.7 cents per hour and a driver at 10 cents per hour, the driver cost is 17.9 per cent of the total per hour. Corresponding percentages for 3-, 2-, and 1-mule teams are 19.6, 26.7, and 42.2. It is quite evident that the effectiveness of man labor can be increased by increasing the size of team up to the maximum capacity of the driver for handling mules. Not only the power unit, but the human operator of the unit as well, should be used up to the maximum capacity consistent with quality work and flexibility under the existing conditions.

Timeliness of operations is an important factor in measuring the efficiency of cultural practices and the ability of a power unit to cover a large area in a unit of time is an outstanding factor in timeliness. This is an argument in favor of tractor power. However, it is possible to place sufficient mules in a team by use of the proper hitches to do the work of the most powerful farm tractor, granting, of course, that there is sufficient room at turn-rows. Furthermore, mules are capable of exerting for short periods, several times their ordinary working power, and of being adaptable to use in either large or small units.

In the last analysis, most plantations of the Yazoo-Mississippi Delta may find that both tractors and mules are necessary for most efficient opera-

tions. The proper proportions of each will depend on the kind of soil, crops grown, type of labor supply, individual preference and other considerations. The most important factor to guard against is duplication of power. Tractor and mule power should be so proportioned that the maximum use may be had from each.

PRODUCING COTTON WITH TRACTOR POWER

Of more specific interest is the possibility of producing cotton with tractor power. A number of examples of such production were met with during the study, but the number was insufficient to justify any definite conclusions. Those who had tried it were well pleased with the results. The tabulations show some results on a few plantations.

Table 18 shows the time used and calculated costs when handled with tractors and cost on a similar acreage handled with mules on plantations where tractors were not owned. No driver labor is included in either case. Approximately .87 of an hour of mule work per acre was applied to the acreage operated with tractors. This was for carrying water, fertilizing and cutting stalks.

Table 18. Comparative costs, exclusive of drivers, of tractor and mule power in the production of cotton

Item	With tractor power		With mule power	
Number of acres considered	1768		1767	
Average yield lint per acre—lbs.	346		393	
	Tractor hrs.	Dollars	Mule hrs.	Dollars
Weighted average time and costs per acre:				
Cutting stalks	.03	.02	2.04	.28
Disking	.96	.59		
Plow and run rows	.07	.04	4.53	.62
Middle busting	.39	.24	2.91	.40
Harrowing	.35	.21	1.14	.16
Planting and fertilizing	.49	.30	2.69	.37
Cultivating	3.93	2.40	29.79	4.08
Totals	6.22	3.80	43.10	5.91
For .87 hours mule work		.12		
Grand total power costs per acre		3.92		5.91
Per pound lint		.011		.015

Very little stalk cutting was done with tractors and no disking was done with mules.

The costs were calculated by applying a rate of 61.1 cents per hour, the average for all tractors, less wages, to tractor hours and a rate of 13.7 cents per hour, the average for all mules, to mule hours. In the mule operated crop, various sized teams were used.

Four-tenths of a cent difference in favor of tractors occurs in cost of power per pound lint where nothing else is considered. However, if drivers are included at 20.8 cents per hour for tractor driver and 10 cents per hour for mule driver, and it is assumed that the average size of team was two mules, costs will be increased \$1.31 and \$2.15 per acre for tractor and mules respectively. The corresponding costs per pound lint would be increased to 1.5 and 2.1 cents, with a difference of six-tenths of a cent, while had yields per acre been equal at 346 pounds, the costs per pound would have been 1.5 cents for tractor and 2.3 cents for mules.

Growing cotton up to picking time is the easiest part of cotton production. Picking the crop constitutes one of the major problems, while hoeing and chopping may be difficult to handle where tractor power is used exclusively. Table 19 shows in tabular form some of the differences in handling methods for the two acreages of cotton considered in Table 18.

Table 19. Differences in cultural practices.*
Tractors and mules used for power

Item	Times over	
	1768 acres with tractors	1767 acres with mules
Cut stalks	.16	1.00
Disk	1.88	
Plow and run rows	.12	.75
Middle busting	1.00	.77
Harrowing	.84	.77
Planting and fertilizing	1.43	2.13
Cultivating	10.25	14.90
Hoeing and chopping	2.23	3.22
Seed cotton per acre—Founds	1037	1180

* As applied to the two respective acreages shown in Table 18.

The mule operations were somewhat more intensive and the yield made with mules somewhat larger. Practically all the tractor grown cotton was picked by hired labor. Cotton picking data were not tabulated because of the great variability in pickers and picking time. Men, women and children are used for cotton picking, and rain, dew and disinclination on the part of pickers cause the picking time to vary greatly.

The greater part of the cotton crop was picked by those who had produced it as share hands, but cotton produced with tractor power and some wage cotton produced with mules was hoed, chopped and picked with hired labor. This hired labor may be grouped into four general classes. The first class consists of share croppers living on the place who may be hired when not busy with their own crop. Practically all hired hoe labor was of this type. This class of labor is the most satisfactory, but the quantity is quite limited. Negro labor from surrounding towns and cities is perhaps the next in importance. These laborers had to be hauled daily. Competition for their services had made them independent and, as a class, they were reported as not very dependable. Negroes brought in from outside the Delta constitute

A GROUP OF COTTON PICKERS



Fig. IX—These pickers are a product of the Old South, and at present, constitute the principal means of getting cotton picked. Picking capacity and efficiency vary with size and inclination. With constant improvement taking place in the mechanical cotton picker, who can fortell the future for these children of the soil—and for cotton?

a third class. They must be recruited and assembled on the place, but, as a rule, they return to their homes at their own expense. These laborers ordinarily give satisfaction for a short time, but they rarely stay on the job until it is finished. With money enough for new clothes and railway fare home, such laborers find steady work irksome and fail to remain on the job. The fourth class of such labor is that composed of Mexicans brought in from southern Texas. They give good service and stay to the finish. They are ordinarily transported from their homes and returned, the cost of such transportation entering into the cost of cotton picking. Up to the time of the study, no scarcity of this type of labor had been encountered, but it is not known just how much could be depended upon at a given wage.

Picking is at present the factor which limits the production of cotton with tractor power. Certainly there is a limit to the amount which can be profitably picked with hired hand labor. On the other hand, improvements are being constantly made in mechanical cotton pickers, and when these become successful they will, no doubt, revolutionize cotton production.

Table 19 suggests that with an increase of tractor power, there may be a drift toward more extensive production methods with lower acre yields on a larger acreage. This is contrary to the opinion of eleven of the 66 tractor owners interviewed who believed that the use of mechanical power increased productivity. One owner thought such power decreased productivity, 31 thought it made no difference and the remainder did not express an opinion. Deeper plowing and more timely tillage operations no doubt have a beneficial effect on the productivity of the crops on which the power is used, while the omission of hoeing and chopping operations may affect the crop adversely. Whether any advantage gained by the use of mechanical power is retained or is dissipated on other operations on the crop or other plantation enterprises is another matter. As a possible check on the relationship of tractor power and crop yields, 88 plantation records were sorted into two groups—60 owning tractors and 28 not owning tractors—and cotton and corn yields compared. The data are shown in Table 20.

Table 20. Cotton and corn yields on tractor and non-tractor plantations

Item	Tractor plantations	Non-tractor plantations
Plantations in group	60	28
Acreage of cotton operated by group	45051	16427
Acreage of corn operated by group	9361	3691
Tons of fertilizer used by group	2284	715
Average yield of lint cotton per acre—pounds	398	381
Average yield of corn per acre—bushels	24	20
Fertilizer used per acre—pounds	47	71
Acreage of cotton per acre of legume crops	10	17
Acreage of corn per acre of legume crops	2	4

Both cotton and corn made higher average yields on plantations where tractors were owned than on other plantations although the latter group applied more fertilizer per acre. The distribution of fertilizer to particular crops was not obtained on the record. The average application shown was obtained by dividing the sum of the cotton and corn acreage into the total amount of fertilizer used. Of the 60 tractor owning operators, 54 reported the use of fertilizer. Fifty-one fertilized cotton, 27 fertilized corn and 5 fertilized other crops. Twenty-three non-tractor owning operators used fertilizer; all applying it to cotton, 5 applying it to corn, and 2 to other crops. Tractor owning operators grew one acre of legumes to each 10 acres of cotton and 2 acres of corn, while non-tractor operators grew one acre of legumes to each 17 and 4 acres of cotton and corn respectively. Since nitrogen is the principal plant food needed by Delta soils, it is evident that tractor owners were making a greater use of legumes to supply the need than were non-

tractor owners. Logical reasoning leads one to believe that the better yields on the plantations operating tractors were not wholly due to the tractors, but that the land was naturally more fertile and that the operators managed somewhat better.

COMPARISON OF TRUCKS AND MULES FOR ROAD HAULING

It has been shown that, from the data at hand, the ton-mile cost of road hauling with trucks is much less than that with mules. An attempt was made to determine if there were particular kinds of hauling, or particular conditions under which one would prefer one form or the other. Nothing of this nature could be found from the available data. A downward trend in the cost per ton-mile was shown as the size of truck load was increased. A similar array of loads drawn by mules was not accompanied by any observable trend in the costs. The distances hauled had no observable influence on costs per ton-mile regardless of whether hauling was with trucks or mules.

In considering the relative merits of trucks and mules for road hauling, this study presents an incomplete picture. The evidence seems greatly in favor of trucks, but where a certain number of mules are kept regularly for other purposes, they may as well be used for hauling, thus reducing the per unit cost of mule work on all operations. Mules have the advantage of being capable of division or multiplication into power units of various sizes for particular purposes, and they may be used under conditions impossible for a truck. In favor of the truck are speed on the road and the ability to stand constant use. These characteristics permit of opportune use and the covering of long distances in a minimum of time. Such values can not be calculated in money, but the data shown and the foregoing suggestions may at least aid the plantation operator in solving his road hauling problems.

There is ample room for improvement in the use of all forms of power whether mechanical or animal. Certain costs as interest, depreciation and taxes are constant and other costs may be materially reduced by careful management. After the total of fixed and variable costs have been reduced to the minimum consistent with satisfactory service, the power unit should be utilized productively to its fullest extent in order to obtain the minimum use cost.

Report of the
Holly Springs Branch
Experiment Station, 1931

* * *

BY
OTIS B. CASANOVA

Mississippi Agricultural Experiment Station
A. & M. College, Mississippi
W. R. Perkins, Director

Annual Report of the Holly Springs Branch Experiment Station For 1931

By
OTIS B. CASANOVA*

Most of the experimental work treated in this report was begun in previous years. Special emphasis was given to cotton production with some work devoted to legumes and grains. Over twelve hundred experimental plots were used, five hundred dealing with soils and fertilizers and seven hundred dealing with crops and cultural methods.

Studies in soil erosion are in co-operation with the United States Department of Agriculture through the Southern Forest Experiment Station, New Orleans, Louisiana. The factors affecting soil erosion and the best method of its control are to be determined.

The work of this station was designed solely to assist the farmers in solving their farm problems, not to make money. The station can best serve the farmers if they visit the station frequently to inspect the work and discuss their problems. Several thousand visitors came to the station this year. On Field Day alone, September 17, there were about eleven hundred visitors present.

Seasonal conditions were not ideal for maximum crop yields. Abundant rainfall in April and May was conducive to excessive stalk development and the droughty condition during June and July caused cotton to shed considerably. Corn, sorghum, and soybean yields were highly satisfactory both for silage and grain. The light infestation of boll weevil in June was checked by the extremely dry weather. The cotton hopper destroyed all but the top crop on the rank valley cotton, designated as the Valley Varieties and Valley Fertilizer tests. Sorghum midge destroyed almost the entire crop of grohoma and atlas sorgho while adjoining plots of sagrain and Japanese seeded ribbon cane were slightly affected.

Cotton Varieties

The purpose of this test is to determine the varieties of cotton that are most productive and best adapted to the soil and climate of this section.

Cotton variety tests were conducted on both the hill and valley lands. Each variety was planted in single rows in four replications. Accurate weights of seed cotton were secured on each row at harvest time. One hundred boll samples were picked to ascertain yield, lint percentage, staple, and boll size. The

*Mr. T. F. McGhee, Assistant Director in Charge from September 1, 1930, to September 1, 1931.

value of lint in cents per pound was determined for each variety from the average value of its staple over a period of time as quoted by the leading cotton markets. Seed was valued at ten dollars per ton. The data from the Hill and the Valley Land tests are given in Table 1 as three and five-year averages. The

Table 1
Standard Varieties—Hill and Valley

Varieties	Hill Cotton Variety				Valley Cotton Variety			
	Average 1929-31		Average 1926-31		Average 1929-31		Average 1926-31	
	Lb. lint per acre	Value per acre	Lb. lint per acre	Value per acre	Lb. lint per acre	Value per acre	Lb. lint per acre	Value per acre
Stoneville 3	566	72.93			681	100.20		
Missdel 2	530	67.93			643	93.30		
Stoneville 2	503	64.83			610	90.10		
D. & P. L. 4-8	449	60.25	452	72.86	557	87.78	625	111.17
Lightning Express	419	58.82	426	76.44	530	83.58	537	107.00
Lone Star 561	446	58.28			530	79.95		
Missdel 1	429	58.14			548	88.91		
Cleveland 54	459	58.05	454	70.57	620	91.23	627	108.53
Deltatype Webber	398	57.15	384	74.15	433	74.15	472	105.38
Cleveland Wilson	468	56.96	449	68.34	551	77.58	555	93.56
Half & Half	522	55.58	528	74.17	599	76.15	622	96.43
Miller 589	355	55.16			544	88.04		
Acala	392	54.23	423	71.09	501	77.30	553	99.94
Cleveland Piedmont	431	52.88	430	64.74	501	71.46	546	91.79

Table 2
Main Cotton Variety Test—Valley

Varieties	Lb. lint per acre	Per cent lint	Staple	Cents per lb.	Value per acre	Bolls per lb.
Missdel 2	686	31.0	1 3/32	6.90	54.98	81
Delfos 531	600	31.0	1 1/8	7.35	50.75	78
Missdel 1	503	30.7	1 3/32	6.90	40.39	68
Stoneville 2	470	30.5	1	6.10	34.05	71
Stoneville 3	462	33.3	31/32	5.90	31.88	73
Lone Star 562	419	34.1	1	6.10	29.61	65
Light. Express	359	29.3	1 3/32	6.90	29.10	72
Farm Relief	361	31.9	1 3/32	6.90	28.78	61
Cleveland 884-4	379	31.1	1 1/32	6.40	28.46	65
Deltatype Webber 9	297	31.2	1 3/16	8.30	27.97	64
D. & P. L. 10	364	31.0	31/32	5.90	25.51	78
Cleveland 54	327	30.8	23/24	5.85	22.68	69
D. & P. L. 4-8	319	34.6	31/32	5.90	21.85	71
Acala 37	284	32.5	1	6.10	20.28	68
Rowden 2088	288	30.7	31/32	5.90	20.28	59
Lone Star 561	279	32.0	1	6.10	19.96	63
Wilson Type	277	30.0	29/32	5.60	18.75	70
Express 17	227	29.5	1 1/16	6.65	17.84	71
Cleveland Piedmont	236	30.9	7/8	5.50	15.63	68
Half & Half—Mahon	316	34.6	27/32	4.00	15.60	65
Miller 610	202	32.4	1	6.10	14.43	56
Miller 589	190	32.6	1	6.10	13.53	60

Table 3
Main Variety Test—Hill

Varieties	Lbs. lint per acre	Per cent lint	Staple	Cents per lb.	Value per acre	Bolls per lb.
Delfos 531	898	34.2	1 5/32	7.85	79.15	80
Missdel 2	892	36.3	1 3/32	6.90	69.38	85
Stoneville 3	814	37.6	1	6.10	56.41	76
Cleveland 884-4	798	35.3	1	6.10	56.02	72
Stoneville 2	743	36.0	1 1/32	6.40	54.19	70
Missdel 1	623	35.3	1 3/32	6.90	48.72	71
Deltatype Webber 9	577	33.6	1 1/8	7.35	48.12	71
D. & P. L. 10	687	38.0	31/32	5.90	46.12	77
Light. Express	571	32.6	1 1/16	6.65	43.88	78
Lone Star 561	605	36.6	1	6.10	42.13	66
Lone Star 562	598	37.0	1	6.10	41.61	64
Wilson Type	629	33.8	29/32	5.60	41.41	70
Cleveland 54	600	35.7	15/16	5.75	39.92	72
Farm Relief	515	36.2	1 1/16	6.65	39.66	70
Cleveland Piedmont	557	34.0	7/8	5.50	36.05	69
D. & P. L. 4-8	522	39.4	15/16	5.75	34.04	78
Acala 37	463	34.0	1	6.10	32.77	78
Express 17	424	34.4	1 1/16	6.65	32.23	77
Half & Half—Mahon	631	40.3	27/32	4.00	29.92	72
Rowden 2088	351	34.2	31/32	6.90	24.07	64
Miller 589	250	36.3	31/32	5.90	16.93	64
Miller 610	230	37.8	1	6.10	15.94	63

Hill test received 700 pounds of 4-8-8 fertilizer per acre, and the Valley test 600 pounds.

Nitrogen Sources Test

The purpose of this test is to determine the relative efficiency of the various sources of nitrogen in cotton production. The test was conducted on a uniform unimproved brown loam

Table 4
Main Nitrogen Sources Test with Cotton

Nitrogen sources	Average 1929-31			1931			Bolls per lb.
	Acre yield	No nitrogen check	Increase	Acre yield	No nitrogen check	Increase	
Leunasalpeter	829	309	520	952	157.5	794.4	79.2
Nitrate soda	829	313	516	972	325.0	647.0	75.6
Cal-Nitro	811	304	507	822	175.0	647.0	77.7
Ammonium sulphate	859	375	484	962	295.0	667.0	76.1
Calurea	808	354	454	876	265.0	611.5	77.6
Calcium nitrate	763	354	409	616	257.5	358.5	76.8
Cyanamid	738	334	404	762	235.0	527.0	77.2
Ammonium nitrate ¹				842	195.0	647.0	76.9
Amm. Sul. & Nit. Soda ²	776	412	364				
No fertilizer	307	271	36	190	122.5	67.5	83.6
No nitrogen	313	313		190	190.0		84.1

1. One year (1931)
2. Two years (1929-30)

soil which had been continuously cropped to cotton for 75 years or more. All plots were one-twentieth acre in size, composed of four rows, and repeated three times.

A uniform application of 600 pounds of 0-12-6 fertilizer was made to all except the no fertilizer plots, and 36 pounds per acre of nitrogen from the various sources applied to the respective plots. The combination, ammonium sulfate-nitrate of soda application was discontinued this year and ammonium nitrate-calcium carbonate substituted. The data are given in Table 4 as one and three-year averages and arranged according to the three-year average yield.

Secondary Nitrogen Sources Test

The Secondary Nitrogen Sources test was conducted under the same conditions as the Main Nitrogen Sources test. Results for one year only are presented. The 1930 results were unsatisfactory due to poor stands and late plantings.

Table 5
Secondary Nitrogen Sources Test with Cotton

Nitrogen sources	Acre yield	No nitrogen check	Increase	Bolls per lb.
Arcadian nitrate soda	640	268	372	76.1
Chilean nitrate soda	572	284	288	77.9
Urea	544	272	272	76.0
Ammonium nitrate	476	245	231	78.8
Cal-Nitro	459	249	210	76.4
Cottonseed meal	448	265	183	78.4
Nitrophoska (12-24-12)	433	257	176	79.9
Ammophoska (12-24-12)	395	253	142	81.4
Nitrophoska (16-16-21)	352	241	111	79.0
No nitrogen	276	276		81.3
No fertilizer	181	280	-99	83.8

Phosphorus Sources Test

The purpose of this test is to determine the relative efficiency of the various phosphates in cotton production. The

Table 6
Phosphorus Sources Test with Cotton

Sources	Average 1929-31			1931			Bolls per lb.
	Lb. seed cotton per acre	No phosphorus check	Increase	Lb. seed cotton per acre	No phosphorus check	Increase	
Superphosphate	945	850	95	794	588	206	83.0
Ruhm's phosphate	893	834	59	626	561	65	76.7
Colloidal phosphate	848	842	6	578	553	25	79.2
No phosphate	826	826		570	570		77.4
No fertilizer	641	819	-178	304	579	-275	87.0

data are presented in Table 6 as one and three-year averages. Six hundred pounds per acre of 6-0-6 fertilizer was applied to all plots except the no fertilizer plots. The phosphatic materials were applied, irrespective of analysis, at the rate of 300 pounds per acre to their respective plots.

Potash Sources Test

This test was designed to test the relative efficiency of the potash in the various potash carriers in cotton production. The data are presented for 1931 and as an average of the result for three years, 1929-31. Plots used were similar in size, arrangement, and kind of soil to those used for the nitrogen sources tests.

Six hundred pounds of 6-12-0 fertilizer per acre was applied to all plots with the exception of the no fertilizer plots.

Table 7
Potash Sources Test with Cotton

Sources	Average 1929-31			1931			Bolls per lb.
	Lb. seed cotton per acre	No potash check	Increase	Lb. seed cotton per acre	No potash check	Increase	
Muriate	955	844	111	954	836	118	77.6
Kainit	926	816	109	976	863	113	71.8
Sulphate	876	809	67	944	843	101	77.1
Manure salt	852	811	41	834	828	6	74.1
Trona	836	808	28	822	857	-35	76.6
No potash	825	825		854	854		77.1
No fertilizer	387	834	-447	214	845	-631	84.1

Table 8
Potash Rates Test with Cotton

600 lb. per acre N-P-K	1929-31			1931			Bolls per lb.
	Lb. seed cotton per acre	No potash check	Increase	Lb. seed cotton per acre	No potash check	Increase	
8-12-6	744	657	87	693	666	27	74.4
No fertilizer	298	668	-370	244	658	-414	83.0
8-12-0	679	679		649	649		75.4
8-12-2	780	691	89	801	641	160	73.5
8-12-4	845	702	143	812	632	180	75.0
8-12-6	800	713	87	650	623	27	73.8
8-12-8	811	701	110	632	636	-4	73.5
8-12-10	796	690	106	674	648	26	74.2
8-12-12	806	678	128	649	660	-11	73.3
8-12-6	754	667	87	699	672	27	73.9

The potash materials were applied at the rate of thirty-six pounds of potash (K_2O) per acre. The results for 1931 and for a three-year average are given in Table 7.

Potash Rates Test

This test was conducted on the same kind of soil as used for the potash sources tests, unimproved brown loam. In addition to the results of 1931, Table 8 gives a three-year average for this test. All plots were one-twentieth acre in size, composed of four 40-inch rows, and repeated three times.

Hill Fertilizer Test

This test was designed to ascertain the most economical fertilizer combination as well as rate of application in cotton production. The plots were one-twentieth acre in size, composed of four 40-inch rows, and the test planted in four replications. The soil used was very poor brown loam which had grown cotton continuously for seventy-five years, or more.

All fertilizers were applied at the rate of 600 pounds per acre, except the 1200, 1800, and 2400-pound applications, and were made from 16% nitrate of soda costing \$46.00 per ton, 16% superphosphate costing \$16.00 per ton and 48% muriate of potash costing \$44.00 per ton. These prices of fertilizers are used in making all calculations of gain or loss due to fertilizer treatment.

Table 9
Hill Fertilizer Test

N-P-K	Average 1930-31			1931			
	Lb. seed cotton per acre	In- crease	Net gain	Lb. seed cotton per acre	Check	In- crease	Net gain
Nitrogen variation							
8-8-4	910	581	3.42	1010	222	788	5.36
6-8-4	887	581	5.03	1018	202	816	7.63
4-8-4	823	426	3.14	875	281	594	4.93
2-8-4	554	236	-5.0	554	318	236	-5.0
0-8-4	339	-1	-3.48	339	340	-1	-3.48
Phosphorus variation							
4-10-4	696	330	.24	720	274	446	1.38
4-8-4	823	426	3.14	875	281	594	4.93
4-6-4	654	370	2.87	635	183	452	2.70
4-4-4	607	324	2.66	535	185	350	1.25
4-0-4	531	124	-1.02	371	296	75	-3.04
Potash variation							
4-8-8	802	360	0.20	848	320	528	2.50
4-8-6	789	370	1.05	837	300	536	3.25
4-8-4	823	426	3.14	875	281	594	4.93
4-8-2	717	343	1.47	765	261	504	3.67
4-8-0	694	343	2.10	734	242	492	4.00
4-8-4 variation							
600 lbs.	823	426	3.14	875	281	594	4.93
1200 lbs.	1057	753	3.65	1313	207	1106	8.22
1800 lbs.	1164	840	-2.00	1529	299	1230	5.14
2400 lbs.	1279	934	-7.24	1727	251	1476	1.71
No fertilizer	392			288	288		

Table 9 gives the results for 1931 and the average results for 1930-31. The increase represents the difference in pounds of seed cotton per acre between the fertilized and the unfertilized plots. The fertilizers under trial are grouped according to the variations of nitrogen, phosphorus, potash, and rate of application.

Valley Fertilizer Test

The purpose of this test is to ascertain the most profitable fertilizer combination and rate of application.

The soil is improved brown loam valley land. Each plot was one-twentieth acre in size, composed of four 40-inch rows, and the treatment repeated three times. All fertilizers were applied at the rate of 600 pounds per acre, except the 1200, 1800, and 2400-pound applications and were made from nitrate of soda, superphosphate and muriate of potash.

Table 10 presents the results for 1931 and the average results for seven years. The increase represents the difference, in pounds of seed cotton per acre, between the fertilized and the unfertilized plots. The fertilizers under trial are grouped according to their variations of nitrogen, phosphorus, potash, and rate of application. This is the first season in seven years that yields secured from every fertilizer application in this test failed to make a profit. We attribute this to hopper damage and unfavorable weather conditions.

Table 10
Valley Fertilizer Test

N-P-K	Average 1925-1931			1931			
	Lb. seed cotton per acre	In-crease	Net gain in dollars	Lb. seed cotton per acre	Check	In-crease	Net gain in dollars
Nitrogen variation							
8-8-4	1334	429	11.86	364	348	16	-10.09
6-8-4	1391	481	16.96	393	341	52	-7.44
4-8-4	1372	493	19.66	495	413	82	-5.32
Phosphorus variation							
4-8-4	1372	493	19.66	495	413	82	-5.32
4-6-4	1357	447	17.02	519	340	179	-2.78
4-4-4	1267	355	12.94	415	339	76	-4.23
Potash variation							
4-8-8	1545	661	26.51	682	508	174	-4.56
4-8-6	1431	550	21.52	521	461	60	-6.29
4-8-4	1372	493	19.66	495	413	82	-5.32
4-8-2	1205	319	10.44	360	360	0	-6.39
4-8-0	1026	129	1.42	307	354	-47	-4.90
4-8-4 variation							
600 lbs.	1372	493	19.66	495	413	82	-5.32
1200 lbs.	1522	618	19.16	388	340	48	-12.94
1800 lbs.	1548	651	13.00	295	343	-48	-19.90
2400 lbs.	1590	701	7.36	277	345	-68	-26.44
No fertilizer	893			390	390		

Corn Varieties

The purpose of this test is to determine the varieties of corn that are most productive and best adapted to the soil and

climate of this section. The test is composed of twenty varieties, each planted in single rows and repeated eight times. Highly improved brown loam valley land was used and 400 pounds of 4-8-6 (N-P-K) fertilizer applied per acre. The date of planting was April 28. Table 11 gives the results for 1931 and the average results for 5 years. The varieties are arranged in order of their grain production for 1931.

Table 11
Corn Variety Test

Varieties	1931		Average 1927-31	
	Bu. grain per acre	Per cent grain	Bu. grain per acre	Per cent grain
Hastings	84.2	86.8	73.4	83.2
Dixie White Dent	71.2	85.6	-----	-----
College G-4	67.7	80.9	-----	-----
Cocke's Prolific, Station	67.5	84.6	65.7	82.3
Jellicorse	65.8	84.3	-----	-----
Mosby, Delta	63.7	84.8	61.8	81.7
Mosby Station	62.9	86.0	63.1	81.3
Paymaster	62.1	83.5	64.3	81.0
College 47	60.1	81.3	-----	-----
College Y 4	59.9	84.4	-----	-----
Cocke's Prolific, Wood	48.8	82.6	-----	-----
Laguna	48.7	85.0	53.3	79.2
Mosby, Suttle	45.5	87.1	56.0	83.4
Golden Dent R. H.	44.8	84.5	-----	-----
Mexican June	44.7	84.6	47.3	79.4
Jarvis	43.4	84.9	-----	-----
Improved Golden Dent	31.5	82.8	48.2	76.4
Yellow Dent Ferguson	27.6	84.8	-----	-----
Reese's Drouth Resister	25.5	81.9	-----	-----

Silage and Grain Test

The purpose of this test is to determine the relative silage and grain productive values of corn, sagrain, sorghum, atlas sorgo and grohoma.

All plots were one-twentieth of an acre in size, composed of four 40-inch rows, and the treatments repeated four times. The soil used was unimproved brown loam table-land. Six hundred pounds of 4-8-6 (N-P-K) fertilizer was applied per acre, and the crops planted June 1. The two outside rows on each plot were harvested for silage yields and grain yields determined on the middle two rows.

Grohoma and atlas sorgo were severely damaged by the

Table 12
Silage and Grain Test

Crops	Tons silage	Bushels grain
Japanese seeded ribbon cane	15.0	7.3
Corn	8.4	65.9
Atlas sorgo	8.2	6.2
Grohoma	6.4	5.9
Sagrain	5.3	24.0

sorghum midge, while the sagrain and Japanese seeded ribbon cane were damaged very little. Corn is our safest feed grain crop. Japanese seeded ribbon cane has so far been unsurpassed at this station for silage production; a greater tonnage and a more satisfactory silage has always been secured from it.

Winter Cover Crops for Corn

This test is designed to study the effects of plowing under winter cover crops upon the yield of succeeding crops of corn over a period of several years. The test is composed of ten plots one-twentieth acre each and repeated four times. Fertilizer was applied under corn at the rate of 400 pounds per acre where designated.

Vetch, Austrian pea, crimson clover, and rye made growth that was highly satisfactory, but red clover made poor growth probably due to insufficient lime. The cover crops were planted October 2, 1930, plowed under May 1, 1931, and the land planted to Golden Jarvis corn May 23, 1931. Table 13 presents the results for 1931 in yield of corn per acre and the height of cover crop when plowed under.

Table 13
Winter Cover Crops for Corn

Treatment	Fertilizer	Bu. corn per acre	Bu. increase over 0-8-4	Height of cover crop
No cover	0-0-0	50.4	-16.2	
No cover	0-8-4	66.6		
No cover	6-8-4	78.0	11.4	
Red clover	0-8-4	69.3	2.7	20 in.
Austrian winter pea	0-8-4	85.0	18.4	32 in.
Hairy vetch	0-8-4	85.2	18.6	42 in.
Crimson clover	0-8-4	86.7	20.1	24 in.
Abruzzi rye	0-8-4	52.3	-14.3	5.5 ft.
Abruzzi rye	6-8-4	61.2	-5.4	6.0 ft.

Rotation Studies with Cotton, Corn, Sorghum, and Hairy Vetch

Two adjoining tracts of land, about six acres each, were built up to similar fertility by sixteen years of crop rotation, including legumes, which increased the organic matter and nitrogen content of the soil. In 1925 a cotton fertilizer test was started on one of these tracts and has been repeated annually without cover crops. The adjoining tract of six acres was divided into two, three-acre plots and continued in a rotation as follows: first year, cotton followed by vetch and the vetch allowed to mature; second year, corn or silage followed by a volunteer crop of vetch, occasionally cut for hay; and third year, cotton. The volunteer vetch was plowed under about the first week in April in time for planting cotton April 21. Cotton was alternated from one plot to the other with corn and soybeans, or sorghum. Each year the rotation plot received an application of 600 pounds of 4-8-8 fertilizer, which is the

same treatment given the continuous cotton plot. Table 14 presents the results of this study in pounds of seed cotton per acre extending over a period of seven years.

Table 14
The Effect of Rotation and Commercial Fertilizer on the
Yield of Cotton

	Yields in pounds of seed cotton per acre							Average
	1925	1926	1927	1928	1929	1930	1931	
Cotton continuously without fertilizer	1561	1213	824	786	763	714	390	893
Cotton continuously and 600 lbs. 4-8-8	1996	2065	1238	1605	1814	1414	682	1545
Cotton in rotation and 600 lbs. 4-8-8	1550	1973	1637	2148	2401	1970	1061	1820

The trend of production on the two plots cropped continuously to cotton is downward, gradually downward on the plot receiving 600 pounds 4-8-8 fertilizer, and rapidly downward on the no fertilizer plot. Excepting the last two unfavorable years, the rotation tract shows an improvement in productivity. The average yield is 1820 pounds of seed cotton per acre.

Organic Matter and Nitrogen—The lack of organic matter and nitrogen are important causes of low crop yields on most soils of Mississippi. Their low content of organic matter is responsible for a great amount of erosion. In this section of the state soil erosion is removing many times more plant food from the soil than crops are. The organic matter in most soils must be increased in order to obtain the best results from the use of fertilizers and lime.

Crop residues, stable manures, and green manures are three important sources of organic matter for the soil. Of these, crop residues are the cheapest. Stable manure is a valuable source of organic matter but it furnishes less material than crop residues. Green manure crops which do not take the place of other crops in the rotation may be used to good advantage, but cover crops which replace regular crops are generally too expensive to use.

The nitrogen requirements for crop production can be supplied economically to soils in this section of the state from the use of summer and winter legumes. Since nitrogen is a limiting factor in most soils of the state, their productive power can be built up greatly by including leguminous crops in the cropping system. Soybeans, vetches, peas, and some clovers have proved their worth as soil builders.

Summary

In a test of 14 standard varieties of cotton, Stoneville 3, Missdel 2, Cleveland 54, Stoneville 2, and D. & P. L. 4-8 are the five leading varieties in a two-year average. In the Main Cotton Variety test on valley land, the five leading varieties are: Missdel 2, Delfos 531, Missdel 1, Stoneville 2, and Stone-

ville 3; and on the hill land, Delfos 531, Missdel 1, Stoneville 3, Cleveland 884-4, and Stoneville 2.

In the nitrogen sources test the nitrate form of nitrogen showed some superiority over the other forms of nitrogen, though not decidedly so except in the case of ammophoska and nitrophoska, which gave the lowest yield per acre.

When compared on the basis of 300 pounds of material per acre, superphosphate, Ruhm's phosphate and colloidal phosphate gave increases of 95, 59, and 6 pounds of seed cotton per acre, respectively, in a two-year average, and 206, 65, and 25 pounds per acre for 1931.

In a test with the different sources of potash at the rate of 36 pounds of potash per acre, muriate of potash and kainit showed a slight advantage in a two-year average with cotton. The potash rates test indicates that 24 pounds of potash per acre is perhaps the highest rate justified for cotton on an unimproved brown loam soil.

The result from the Hill Fertilizer test with cotton on an unimproved brown loam soil show the greatest gain from 600 pounds of 6-8-4 fertilizer.

The results of a three-year average in a test of 19 varieties of corn, Hastings, Station Cocke's Prolific, Paymaster, Station Mosby, and Delta Mosby are the five leading varieties in the order named.

In a test comparing Japanese seeded ribbon cane, corn, atlas sorgo, grohoma, and sagrain as sources of silage, Japanese seeded ribbon cane took first place with 15 tons per acre, and corn second place with 8.4 tons. As a producer of grain, however, corn yielded 66 bushels and sagrain 24 bushels per acre. Austrian winter pea, hairy vetch, and crimson clover grown as winter cover crops increased the yield of corn 18.4, 18.6, and 20.1 bushels, respectively, but rye alone reduced the yield 14.3 bushels.

A rotation including vetch showed a considerable improvement in yield of cotton over land continually grown to cotton alone.

REPORT
OF THE
SOUTH MISSISSIPPI BRANCH
EXPERIMENT STATION
FOR 1931

By

J. C. Robert, W. S. Anderson, and W. W. Welborne

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
A. & M. COLLEGE, MISSISSIPPI

W. R. PERKINS, Director.

REPORT OF THE SOUTH MISSISSIPPI BRANCH EXPERIMENT STATION FOR 1931

By
J. C. Robert, W. S. Anderson, and W. W. Welborne

The plans and policies of the South Mississippi Branch Station in former years have been adhered to fairly closely for 1931. Since the station is designed to serve the people, it cannot be expected to be a money making or even a self-supporting enterprise, because money is required to run any business. That business which expends all its energies in serving the people must necessarily have a source of income elsewhere. The station is doing research on the best methods for the production and utilization of farm products, a system of permanent agriculture through crop rotation, legume cover crops and the control of soil erosion, and the distribution of agricultural information to the farmers of all or a part of 27 counties of South Mississippi embracing approximately 10 millions of acres. This region is sufficiently different from the other regions of the state to justify special attention to crop adaptability, methods of cultivation, and general management of the soil.

COVER CROPS

Winter cover crops have been grown on almost all the cultivated land of the station. Those showing special merit are: hairy vetch, monantha vetch, pearl vetch, Austrian winter pea, Canadian winter pea, bur clover, black medic, and crimson clover. Oats, wheat, barley, and abruzzu rye have also done well. Cover crops are very valuable in reducing erosion. Since most of the soils of the Longleaf Pine region contain 20 to 30 per cent of fine sand and silt, the cultivation of the rolling areas makes conditions favorable for severe erosion. Nature's method of preventing erosion and restoring fertility to the land is to cover it with a carpet of grass and clover which also greatly increases the water holding capacity of the soil. According to Dr. H. H. Bennett of the Bureau of Chemistry and Soils, the plant food removed annually from the soils of cultivated fields of the United States is 21 times that removed by crops. Most of this loss is prevented by keeping the land covered with sod.

In order to determine whether certain winter cover crops and fertilizer treatments have a controlling influence on cotton wilt, an experiment was made and the results recorded in Table 1.

Table 1—Effect of Cover Crops with and without Commercial Fertilizers on Cotton Wilt

Cover Crops	Without Commercial Fertilizer		With 600 lbs. 6-8-4 Fertilizer	
	Lbs. seed cotton per acre	Per cent wilt infection	Lbs. seed cotton per acre	Per cent wilt infection
Check	297	35.7	793	34.4
Austrian winter pea	358	46.6	883	37.4
Vetch	409	48.9	861	40.6
Rye	394	41.8	861	40.0
Check plus 4 tons manure	861	42.5	1108	37.7
Oats	337	48.0	867	42.7
Check plus 8 tons manure	1018	40.1	1201	29.5

These results indicate a slight increase in wilt infection for both the winter cover crops and stable manure but a decrease in wilt for the 6-8-4 fertilizer. There is no direct relationship between the wilt infection however, and the yield of cotton, though the manured plots give the highest yields and when supplemented with a mixed fertilizer they show lowest wilt infection.

NITROGEN SOURCES TEST WITH COTTON

This test has been conducted on the same land for four consecutive years. The basic fertilizer used was 0-8-4 at the rate of 600 pounds per acre. The plots to which nitrogen was applied received it at the rate of 36 pounds of nitrogen per acre. The results are given in table 2. The results are averages of triplicate plots with the exception of nitrate of soda, ammonium sulphate, and calcium cyanamid, which were replicated four times.

Table 2—Nitrogen Sources Test with Cotton—B. S. Field

Source of Nitrogen	Lbs. of seed cotton per acre	Check yield	Increase
Check	480	.....	.....
Nitrate soda	950	437	513
Ammonium Sphlate	866	445	421
Cal. Cyanamid	960	452	508
Check	460	.....	.....
Cal Nitrate	810	465	345
Urea	796	470	326
Cal Urea	830	475	355
Leunasalpeter	885	480	403
Check	486	.....	.....

ORGANIC NITROGEN SOURCES TEST WITH COTTON

The object of this test is to determine the comparative efficiency of organic and inorganic nitrogen from different sources under cotton. A uniform fertilizer treatment consisting of 600 pounds per acre of an 0-8-4 fertilizer was made to all plots. Nitrogen from the different sources was applied at the rate of 24 pounds per acre. This test has been conducted on twenty-five 1-20 acre plots for six successive years. The results are given in table 3 and show no decided advantage for one source of nitrogen over another in the five year average.

Table 3—Organic Nitrogen Sources with Cotton—Kendrick Smith Field

Source	Lbs. seed cotton per acre	Check yield	1931	Increase Average 1927-31
Check	483	.....	.....	.....
Dried blood	941	533	408	379*
Fish scrap	855	583	272	213
Tankage	893	633	260	201
Check	683	.....	.....	.....
½ Fish scrap plus ½ Nitrate soda	1032	705	327	222
½ Tankage plus ½ Nitrate of soda	1151	728	423	263
Cal. nitrate	1161	750	411	261
Check	772	.....	.....	.....

*Results from dried blood are for 3 years only.

NITROGEN ANALYSIS AS SIDE DRESSING WITH COTTON

This is the second consecutive year of the test. The basic fertilizer used was 0-8-4 analysis at the rate of 800 pounds per acre. The plots on which the nitrogen was applied before planting received it at the rate of 16 pounds of nitrogen per acre. The rates used in side dressing were 16, 32, and 48 pounds of nitrogen per acre. Triplicate plots were used for each treatment and the results are given in table 4.

Table 4—Nitrogen Analysis Side Dressing with Cotton—B. S. Field

Treatment before planting	Side dressing lbs. nitrogen	Lbs. seed cotton per acre	Check yield	In- crease	Increase 2-year average
0-8-4 .....	.....	517	.....	.....	.....
2-8-4	16	1111	497	614	407
2-8-4	32	1288	477	811	498
2-8-4	48	1354	457	897	576
2-8-8	48	1445	437	1008	573
0-8-4 .....	.....	417	.....	.....	.....

COOPERATIVE NITROGEN AND POTASH ANALYSIS TEST WITH COTTON

This station has conducted cooperative fertilizer tests for several years in different counties on different types of soil using 1-30 acre plots with three replications. The purpose of the tests is to determine what fertilizer to apply to the different soils to obtain best results. The work this year was conducted on eight farms located in the counties of Jones, Forrest, Stone, Harrison, Hancock, and George and the fertilizer applied at the rate of 800 pounds per acre. In Jones county the test was conducted in cooperation with C. N. Dabbs, Smith-Hughes teacher of the Shady Grove Consolidated School, and on the farm of E. N. Lee. In Forrest county two tests were conducted; one in cooperation with W. R. Knight, Smith-Hughes teacher of the Eatonville Consolidated School, on the farm of O. H. Bedsole, and the other with F. O. Cork. In Stone county two tests were conducted in cooperation with G. W. Hughes and S. E. Snowden, Principal of the Home Consolidated School. In Hancock county one test was conducted on the farm of J. E. Smith in cooperation with C. P. Baker, Principal of the Sellers Consolidated School. In George county one test was conducted in cooperation with L. L. Cowart, Smith-Hughes teacher of the Agricola Vocational High School, and on the farm of Harry Bryant. A corn nitrogen sources test was conducted on the farm of Ernest Ladner.

Table 5—Cooperative Nitrogen and Potash Analysis Tests for Cotton

Analysis:	Lbs. seed cotton per acre	Increase over 0-8-4	Lbs. seed cotton per acre	Increase over 0-8-4
(1) O. H. Bedsole—Forrest County			(2) Home Vocational School—Stone County	
0-8-4	860	.....	710	.....
4-8-4	942	82	780	70
6-8-4	980	120	668	—42
8-8-4	894	34	634	—76
8-8-8	938	78	768	58
(3) G. W. Hughes—Stone County			(4) F. O. Cork—Forrest County	
0-8-4	754	.....	604	.....
4-8-4	1142	388	866	262
6-8-4	1174	420	740	136
8-8-4	1056	302	770	166
8-8-8	1112	358	626	22
(5) Harry Bryant—George County			(6) E. N. Lee—Jones County	
0-8-4	812	.....	982	.....
4-8-4	1106	294	1008	26
6-8-4	1070	258	892	—90
8-8-4	1014	202	942	—40
8-8-8	922	110	882	—100
(7) J. E. Smith—Hancock County			Average of the 7 cooperative tests	
0-8-4	1182	.....	843	.....
4-8-4	1186	4	1004	161
6-8-4	1142	—40	952	109
8-8-4	1230	48	934	91
8-8-8	1126	—56	910	67

NITROGEN AND POTASH ANALYSIS TEST WITH COTTON—POPLARVILLE

Two of these tests were carried out on the station farm, one on the Anderson field and the other on the Boyd Smith field. Table 6 gives the results from Anderson field. It will be observed that there was a gradual increase from both nitrogen and potash as the quantity of these fertilizers is increased. The field is highly infested with wilt and, hence, gives a good opportunity to observe the effect of the fertilizer treatments on the control of cotton wilt. While the increase of potash above 32 pounds per acre reduced the wilt some in each case, some beneficial effect resulted also from nitrogen, the source of which is Arcadian nitrate of soda. But complete control was not obtained by any one of the treatments, as the infection counts show. Tables 6 and 7 show only slight increases for either nitrogen or potash in amount above 32 pounds per acre.

Table 6—Potash and Nitrogen Analysis Test with Cotton—A. Field

Analysis 800 lbs. per acre	Lbs. seed cotton per acre	Increase		Per cent wilt infection
		for Nitrogen	for Potash	
6-8-0	500	.....	.....	37.3
6-8-4	565	.....	65	31.7
6-8-8	677	.....	177	24.7
6-8-12	725	.....	225	22.0
0-8-4	262	.....	.....	31.1
4-8-4	552	290	.....	31.4
8-8-4	642	380	.....	27.2

Table 7—Potash and Nitrogen Analysis Test with Cotton—B. S. Field

Analysis 800 lbs. per acre	Lbs. seed cotton per acre	Check yield	Increase 1931	Average 1928-31	
				Lbs. seed cotton per acre	Increase
0-8-4	365	.....	.....	617	.....
4-8-4	1026	383	643	976	349
6-8-4	1224	401	823	1118	481
8-8-4	1338	419	919	1195	548
8-8-8	1406	437	969	1220	563
0-8-4	454	.....	.....	668	.....

POTASH ANALYSIS TEST WITH COTTON

The rates of application of potash ranges from none to 112 pounds of potash per acre. As a basic treatment, all plots received fertilizer at the rate of 800 pounds of a 6-8-0 mixture per acre. Table 8 gives the results which are averages of three replications.

Table 8—Potash Analysis Test with Cotton—B. S. Field

Lbs. potash per acre	Lbs. seed cotton per acre	Check yield	Increase		Per cent wilt infection
			1931	Av. 1928-31	
None	898	.....	.....	.....	13.3
32	1096	913	183	84	7.0
64	1114	928	186	66	6.9
80	1060	944	116	71	6.2
96	1087	959	128	64	3.9
112	1146	974	172	162	5.0
None	990	.....	.....	.....	30.8

This test has been conducted on the same land for four successive years. A basic mixture of 6-8-0 fertilizer was applied to all plots at the rate of 800 pounds per acre and 32 pounds of potash applied from the different sources. The data are given in Table 9 and are averages of three replications.

Table 9—Potash Sources Test with Cotton—B. S. Field

Source	Lbs. seed cotton per acre	Check yield	Increase	Per cent wilt infection
.....	1068	.....	.....	14.6
Muriate	1243	1064	179	5.0
Pot. Sulphate	1142	1060	82	8.5
Kainit	1195	1057	138	1.3
D. M. S.	1102	1054	48	4.8
Check	1051	.....	.....	11.3

POTASH SOURCES TEST WITH COTTON

The potash sources test was started this year and includes five different sources of potash. Last year the soybean variety test was conducted on this land which had received an application of 400 pounds of a 4-8-4 fertilizer per acre. For this test all plots received an application of 800 pounds of an 8-8-0 fertilizer per acre. The potash plots received 64 pounds of potash from the different sources which makes the final application an 8-8-8 fertilizer. The soil is very badly infested with cotton wilt. Table 10 gives the average results from triplicate plots.

Table 10—Potash Sources Test with Cotton

Source	Lbs. seed cotton per acre	Check yield	Increase	Per cent wilt infection
Check	894	.....	.....	11.3
Trona	954	862	92	5.4
Muriate	914	830	84	7.2
Sulphate	872	799	73	11.1
Kainit	888	767	121	13.7
D. M. S.	752	736	16	19.4
Check	704	.....	.....	21.2

Table 11—Potash Sources and Rates Tests with Cotton—Neal Field

Source	No. 1			No. 2	
	Lbs. potash per acre	Lbs. seed cotton per acre	Per cent wilt infection	Lbs. seed cotton per acre	Per cent wilt infection
Check	None	1038	11.8	1207	22.8
Muriate of potash	48	1231	7.7	1155	4.8
Sulphate of potash	48	1150	4.0	1273	4.6
D. M. Salts	48	1262	13.1	1325	6.6
Kainit	48	1293	7.6	1250	4.2
Muriate of potash	24	1204	11.6	1221	10.3
Muriate of potash	60	1017	7.2	1207	14.5
Muriate of potash	72	1255	8.8	1221	6.2

The land on which the potash sources and rates tests were conducted received a uniform treatment of 600 pounds of a 6-8-0 fertilizer per acre. Although the wilt infestation counts indicate some beneficial effect from the potash, the yield shows no such effect.

POTASH SIDE DRESSING WITH COTTON

For the years 1928, 1929, and 1930 a basic mixture of 6-8-4 fertilizer was applied before the planting at the rate of 800 pounds per acre. For this year this same fertilizer analysis was applied at the rate of 600 pounds per acre and muriate of potash applied as a side dressing. The results are given in table 12 and represent the averages of triplicate plots.

Table 12—Potash Side Dressing with Cotton—B. S. Field

Side dressing per acre	Lbs. seed cotton per acre	Check yield	Increase		Per cent wilt infection
			1931	Average 1928-31	
Check	982	.....	.....	.....	11.2
50	931	981	-50	-46	8.2
100	1005	979	26	-20	7.1
150	1061	977	84	18	5.0
200	962	975	-13	-9	6.3
250	1094	973	121	70	6.8
Check	971	.....	.....	.....	11.0

SUPERPHOSPHATE VS. RHUM'S PHOSPHATE

A basic mixture of a 4-0-4 fertilizer was applied to all plots at the rate of 600 pounds per acre. Superphosphate was applied at the rate of 300 pounds per acre and Rhum's phosphate at the rate of 300, 400, and 600 pounds per acre. Table 13 gives the results, and they indicate little or no response to phosphate treatment.

Table 13—Ruhm's Phosphate vs. Superphosphate with Cotton—B. S. Field

Materials	Lbs. per acre	Seed cotton per acre	Check yields	Increase
Superphosphate	300	795	.....	.....
Ruhm's phosphate	600	742	783	-41
Ruhm's phosphate	400	746	770	-24
Ruhm's phosphate	300	762	757	5
Superphosphate	300	744	.....	.....

FACTORY VS. HOME-MIXED FERTILIZERS WITH COTTON

The fertilizers used in this test were: Meridian factory mixed 4-8-4; Plant Food 4-6-4; and home-mixed 4-8-4. In the home-mixed 4-8-4 fertilizer, nitrate of soda, superphosphate, and muriate of potash were used. The results were obtained from six replications and are reported in Table 14. A five-year average shows no significant difference in these fertilizers.

Table 14—A Comparison of Factory-Mixed and Home-Mixed Fertilizer with Cotton—K. S. Field

Material applied per acre	Analysis *	Lbs. seed cotton per acre	Check yield	Increase 1931	Average increase 1937-31
Check		321			
600 Meridian	4-8-4	1204	357	847	531
600 Home-mixed	4-8-4	1267	393	874	544
600 Plant Food	4-8-4	1193	429	764	501
Check		465			

HIGH ANALYSIS VS. LOW ANALYSIS FERTILIZERS WITH COTTON

The comparison of high analysis fertilizers with low analysis fertilizers is being made on 20 one-twentieth acre plots. On this test there are two high analyses and two low analyses of fertilizers used. The 4-8-4 is compared with 12-24-12 and 3-9-3 with 9-27-9. The same amount of plant nutrients is applied to low and high members of each group. The results are given in Table 15. A four-year average shows no difference in crop response between these fertilizers.

Table 15—A Comparison of High Analysis and Low Analysis Fertilizers with Cotton—K. S. Field

Analysis	Lbs. fertilizer applied per acre	Lbs. seed cotton per acre	
		1931	Average 1928-31
4-8-4	600	964	946
12-24-12	200	894	920
9-27-9	200	976	949
3-9-3	600	1007	928

WILT VARIETY TEST WITH COTTON

For the past several years this station has been conducting a wilt variety test to determine the varieties of cotton most resistant to wilt or that produce the highest yield of cotton on wilt infested soil. This year's test included twenty varieties and strains. Each of these varieties was planted in single row plots and in four replications. A uniform application of 800 pounds per acre of a 6-8-4 fertilizer was made to the plots. Table 16 gives the results.

Table 16—Wilt Resistant Varieties of Cotton Compared—A. Field

Variety	Lbs. lint per acre	per cent lint	Length	Cents per lb.	Dollars per acre	Rank	Per cent wilt infection
Cleveland 54	412.5	34.9	29/32	5.60	26.95	4	10.1
Wilson Type	364.9	32.3	27/32	4.00	18.42	15	17.7
Clev. Piedmont	228.2	32.1	13/16	3.50	10.40	19	20.5
Clev. Coker 884-4	250.6	34.1	31/32	5.90	17.21	16	23.0
Half and Half	291.2	42.4	25/32	3.00	10.72	18	28.9
Acala 37	314.8	32.8	1	6.10	22.43	10	14.5
Stoneville 2	371.7	35.1	1	6.10	26.11	7	23.9
Stoneville 3	440.7	37.1	31/32	5.90	29.74	2	33.6
Deltos 46S	343.5	33.0	1	6.10	24.44	8	19.2
Deltos 531	250.0	34.3	1 1/8	7.35	20.76	12	65.6
D. & P. L. 10	393.1	36.0	31/32	5.90	26.68	5	20.7
Lightning Exp. 8	370.8	30.1	1 1/16	6.65	28.97	3	3.1
Express 41077	258.4	34.0	1 1/16	6.65	19.69	14	21.9
Express 17	395.6	34.1	1 1/16	6.65	30.12	1	8.3
Missdel 1	186.8	32.9	1 1/32	6.40	13.87	17	55.3
Miller 610	310.7	33.2	15/16	5.75	21.00	11	18.9
Deltatype Webber	120.7	34.3	1 3/32	6.90	9.49	20	68.9
Rowden	391.6	34.0	15/16	5.75	26.32	6	17.1
Farm Relief	285.3	34.8	1	6.10	20.07	13	51.5
Lone Star 561	356.0	37.4	29/32	5.60	22.92	9	41.2

Table 17—Five year Average—Cotton Varieties—Poplarville—1927-31

	Lint per acre	Total value	Rank in value	Per cent lint	Length
Wilson Type	382.3	59.05	4	33.2	7/8
Cleveland 54	380.9	61.17	3	35.1	15/16
Missrel 2	360.5	63.21	1	33.4	1 1/16
Half and Half	354.0	49.13	10	41.0	25/32
Express	351.9	62.52	2	33.1	1 8/32
D. & P. L. 4-8	346.3	55.29	5	37.3	31/32
Piedmont Cleveland	332.2	52.30	9	33.9	27/32
Lone Star	326.8	54.22	6	35.1	1
Miller	316.5	53.53	7	35.1	1
Acala	311.4	52.57	8	33.8	1
Webber	239.0	46.64	11	31.7	1 5/32

The main cotton variety test includes 22 varieties replicated five times. Cleveland 54 was repeated at intervals to serve as a measure of soil variation. A uniform application of 800 pounds per acre of a 6-8-4 fertilizer was made to all plots. The results are recorded in Table 19.

Table 18—Miscellaneous Cotton Variety Test—A. Field

Variety	Lbs. lint per acre	Per cent lint	Length	Cents per lb.	Dollars per acre	Rank
Cleveland 54	384.7	34.2	29/32	5.60	25.24	11
Clev. 5, Strain 3	340.6	33.9	31/32	5.90	23.42	13
Wanamaker Clev. (Extra Early)	340.0	34.0	1	6.10	24.04	12
Wanamaker Clev. Strain 3	359.3	35.4	29/32	5.60	23.40	14
Wanamaker, Dixie Triumph	476.3	34.9	1	6.10	33.49	2
Rowden 40	331.2	31.4	15/16	5.75	22.66	15
Foster 7	435.2	34.0	1 5/32	7.85	38.38	1
Missdel 1	344.5	31.9	1 3/32	6.90	27.45	9
Missdel 2	392.7	34.0	1 1/16	6.65	29.92	5
Missdel 3	352.0	32.0	1 1/8	7.35	29.61	6
Missdel 4	420.6	35.5	1 1/16	6.65	31.79	3
Lone Star 562	465.5	37.7	31/32	5.90	31.31	4
Miller 613	433.5	34.0	15/16	5.75	29.14	8
Miller 656	398.4	34.2	15/16	5.75	26.74	10
Miller 682	428.5	34.7	31/32	5.90	29.31	7

Table 19—The Main Cotton Variety Test—A. Field

Variety	Lint	Per cent lint	Length	Cents per pound	Total value per acre	Rank in value
Cleveland 54	505.1	33.1	15/16	5.75	34.14	14
Cleveland 884-4	536.0	34.1	1 1/32	6.40	39.48	7
Wilson Type	569.2	32.4	7/8	5.50	37.25	10
Cleveland Piedmont	363.1	33.1	27/32	4.00	18.20	24
Half and Half	449.9	38.1	13/16	3.50	19.41	23
Acala 37	384.2	31.7	1	6.10	27.58	22
D. & P. L. 4-8	456.6	36.1	15/16	5.75	30.29	20
Miller 589	401.1	33.4	1	6.10	28.62	21
Cleveland 54	516.3	33.4	31/32	5.90	35.61	13
Miller 610	459.5	33.3	1	6.10	32.63	15
Rowden 2083	530.6	32.9	15/16	5.75	35.92	12
DeJatyppe Webber	338.9	30.7	1 3/16	8.30	31.95	14
Farm Relief	512.8	34.7	1 3/32	6.90	40.21	6
Lightning Exp. 8	547.6	30.8	1 3/32	6.90	43.93	3
Express 17	484.5	31.9	1 3/32	6.90	38.60	8
D. & P. L. 10	572.1	34.3	1	6.10	40.38	5
Cleveland 54	547.1	32.9	29/32	5.60	36.22	11
Missdel 1	405.0	32.4	1 3/32	6.90	32.22	16
Deftos 531	551.6	32.8	1 1/8	7.35	46.19	2
Missdel 2	495.1	31.7	1 1/16	6.65	38.25	9
Stoneville 2	565.7	32.7	1 1/32	6.40	42.02	4
Stoneville 3	592.0	34.5	1	6.10	46.73	1
Lone Star 561	465.8	34.1	31/32	5.90	31.98	17
Lone Star 562	465.2	34.8	31/32	5.90	31.81	19

CORN VARIETIES

The Main Station at A. and M. College furnished the seed for the 18 varieties of corn which were used in the test. The varieties were planted in single row plots and replicated nine times. Fertilizer of a 4-8-4 analysis was applied before planting at the rate of 400 pounds per acre. Table 20 gives the results.

Table 20—Corn Varieties—Boyd Smith Field

Variety	Bushels corn per acre	Per cent grain	Rank
Mosby Station	31.6	85.0	9
Mosby Delta	32.2	85.0	4
Mosby, Suttle	32.2	87.5	3
Cocke's Pro. Sta.	32.1	85.0	6
Cocke's Pro. Wood	32.1	80.0	5
Hastings	31.9	87.5	7
Jellicorse	32.5	87.0	1
College 47	32.5	85.0	2
Laguna	30.2	81.0	11
Mexican June	31.6	84.7	10
Reese Drouth Resistant	30.2	76.1	12
Paymaster	28.9	87.5	16
Dixie White Dent	31.7	85.0	8
Yellow Dent, Ferg.	30.0	82.0	13
Golden Dent R-H	27.4	85.0	18
College G-4	27.5	85.0	17
Imp. Golden Dent	29.9	85.0	14
Jarvis	29.3	85.0	15

Table 21—Corn Varieties—Poplarville—5 Year Average—1927-31

	Total bushels per acre					Average	Rank
	1927	1928	1929	1930	1931		
Mosby, Station	50.6	36.6	41.0	9.0	31.6	33.8	3
Mosby, Delta	51.0	23.7	36.5	8.8	32.2	30.4	8
Mosby, Suttle	43.9	27.7	31.0	9.6	32.2	28.9	9
Cocke's Prolific	53.7	39.9	34.5	10.0	32.1	34.0	2
Hastings	55.1	34.7	35.5	10.0	31.9	33.4	4
Laguna	49.4	38.2	37.0	11.9	30.2	33.3	5
Mexican June	46.9	37.8	35.0	20.3	31.6	34.3	1
Paymaster	47.1	31.7	35.5	14.3	28.9	31.5	6
Yellow Dent, Ferguson	42.7	28.6	27.5	13.3	30.0	28.4	10
Golden Dent	46.3	31.4	32.0	16.6	27.4	30.7	7

FACTORY-MIXED VERSUS HOME-MIXED FERTILIZERS WITH CORN

The test consists of 25 one-twentieth acre plots and is planned to compare a 4-8-4 home-mixed fertilizer with two popular brands of factory-mixed fertilizers of the same analysis. The home-mixed fertilizer was prepared from nitrate of soda, superphosphate, and muriate of potash. The results are given in Table 22 and show a slight advantage for the home-mixed fertilizer.

Table 22—A Comparison of Factory and Home-Mixed Fertilizers With Corn—K. S. Field

Material applied per acre	Analysis	Bushels per acre	Check yield	Increase over check
Check		19.5		
600 Meridian	4-8-4	38.4	19.6	18.8
600 Home-mixed	4-8-4	40.4	19.7	20.7
600 Plant Food	4-8-4	38.9	19.8	19.1
Check		19.9		

SUGAR CANE

For several years this Station has done cooperative experimental work with the United States Department of Agriculture in an effort to find varieties of sugar cane resistant to the Mosaic and root diseases. The Federal Department has supplied us with numerous varieties, some of which are grown at the United States Sugar Plant Field Station, Canal Point, Florida, where sugar cane flowers and seeds and others have been collected by the Department from various parts of the world. Last year we planted and cultivated 48 varieties of cane; this year we kept only 14 varieties. Three of these—P. O. J. 213, Cayana, and C. P. 807—have been considered of superior merit warranting release for planting. This year we have distributed cane of these three varieties to about 350 farmers in South Mississippi and to some as far north as Lauderdale County. The P. O. J. 213 and Cayana varieties are Mosaic-tolerant, and C. P. 807 is resistant to both the Mosaic and root-rot diseases. The C. P. 807 has proved to be a vigorous grower, exceedingly hardy, and produces

syrup of good flavor. A good crop of C. P. 807 produces from 550 to 650 gallons of syrup per acre. In pounds of sugar per acre, it has out-yielded varieties of P. O. J. by 900 to 1500 pounds per acre. From the data in Table 23 it will be observed that C. O. 290 out-yielded the other varieties in percentage juice and second to Cayana in tonnage per acre.

Table 23—Sugar Cane Variety Test

Variety	Tonage per acre	Per cent juice	Stand percentage
C. P. 807	25.54	60.0	98
P. O. J. 213	13.09	56.89	72
36 M	12.24	61.78	65
P. O. J. 234	14.97	60.18	85
C. O. 290	27.73	62.33	98
Cayana	29.59	59.79	100

SOYBEANS

Soybeans will grow on any soil that produces cowpeas, and have some advantages over them. Soybeans stand up better under extreme weather conditions of temperature and moisture than cowpeas. They are well adapted to grazing and are as rich in protein as alfalfa. The viney types, as Laredo and Ootootan, make a splendid hay. The plant is a good soiling crop, a valuable green manure, and a grazing crop of high value.

The average amount of oil and protein found in seed of 16 varieties by the writers was 17.48 per cent oil, and 38.92 per cent protein. Of 6 varieties showing the highest percentage of oil and protein, the average was 18.89 and 42.37 per cent respectively. Soybeans planted in every third row of corn can be harvested by means of soybean harvester. Ours is of the type drawn by two mules and operated by two men. This harvester threshes the beans and scatters the stems and leaves over the ground. Of the 32 varieties grown in our plots this year, the following showed superior merit: Illini, Manchú, Morse, Mansey, Virginia, Delta 5401, and Biloxi Station.

PEANUTS

As a money crop, peanuts bid fair to occupy an important place in our section of the state. The crop is inexpensive to plant, easy to cultivate, and is harvested with little difficulty. The United States Department of Agriculture has established five grades of peanuts, varying with their purity, development, and freedom from trash, which fact makes peanuts a standard product on the market. The Station grew 75 varieties of peanuts this year, but the major portion of the crop, about two acres, was planted to White Spanish, Jumbo Spanish, Virginia Runner and the Virginia Bunch varieties. We have yet to determine the best fertilizer for yield, and for the prevention of "pops", and the best machine for picking.

TUNG-OIL PLANT

The tung-oil plant has been grown on our Station for five years and has borne fruit three years. Approximately 6000 acres of it is grown in Pearl River County and 2000 acres in adjacent counties. The nuts of this tree furnish an oil valuable for painting, making oil cloth, linoleum, etc. The meal residue left after extracting the oil is a valuable nitrogenous fertilizer, but is said to be poisonous to live stock. The construction of a tung-oil mill in this county is now under consideration. In 1929 alone, 60,000 tons of tung oil was imported and sold at from 12 to 14 cents per pound.

HORTICULTURE

The horticultural investigations include experiments with varieties, cultural methods, propagation, pruning, fertilizers and insect and disease control of most of the horticultural crops that are grown in South Mississippi. More than 700 individual plots, trees, and plants are included in these investigations.

FRUITS

Peaches—Variety, fertilizer, and pruning experiments are being conducted. Varietal recommendations were made in 1930 Station report, Bulletin 285, based upon ten years' results. The old trees have been removed, but the test is being continued with 48 varieties varying in age from 1 to 8 years. The object of this work is to determine the most desirable varieties for home use, markets, and canning. Special attention is being given to finding desirable varieties that will prolong the fruiting season of the home orchard.

The rejuvenation of a 10-year old Early Rose peach orchard has been in progress for one year. The treatments used are light, moderate, and heavy pruning plus 12 pounds per tree of 4-8-4 fertilizer. While conclusions should not be reached after a single year's observation, it is evident that fewer and larger fruits and greater tree growth resulted from trees receiving the heavier pruning.

Pecans—The variety test, which includes 12 varieties, has not produced sufficient crops to warrant definite recommendations. The trees are only 11 years old. Growers should continue to plant the 3 standard varieties, Stuart, Success, and Schley, until other varieties can be recommended.

Grapes—The fact that the better dessert varieties of grapes do not thrive so well as the native varieties necessitates considerable investigational work. Forty varieties of grapes are being grown to determine those which are best adapted to our conditions. Varieties which have produced crops since 1920 are: Delaware, Delicious, Herbemont, Lenoir, and Muench, of the bunch grape group, and Flowers, James, Scuppernong, and Thomas, of the muscadine group. While the Delaware is the most desirable for table use, the others are promising for juice and jelly making. A one-acre vineyard of Thomas was planted in 1929 to demonstrate proper training, pruning, and cultural methods. It produced a light crop of fruit in 1931.

Figs—The studies on seven varieties of figs grown under clean cultivations and straw mulch have been continued. Under clean cultivation Green Ischia is the only variety that produces satisfactory crops. Both Lemon and Seleste produce fruits almost twice as large under mulch culture as under clean culture. Moreover, it has been observed that the trees on mulched areas not only make more growth but also shed their leaves later in the season than do the trees grown under clean cultivation.

Brambles—Observations on the behavior of several varieties of dewberries and raspberries are being continued. The Van Fleet raspberry and Young dewberry are the only varieties found to be apparently suitable for this section.

Citrus Fruits—The experimental plantings include more of the satsuma orange than any other, because it is the most hardy and is most likely to become an important commercial citrus fruit crop in this section. In the winter of 1929-30, some of these trees were killed to the soil embankment while others were not so badly injured. The minimum temperature was 16°F. Three of these cold-resistant trees produced an average of 261 fruits this year, while fourteen of the cold-susceptible trees produced an average of only 48 fruits per tree.

Other citrus fruits in the test are: lemon, Tomasville citrangequat, tangerine, Kumquat, orange, grapefruit, calamondin, citrange, tangelo, and lime. While all of these have made vigorous growths since the injury from cold two years ago and produced some fruits this year, one lemon tree produced 52 fruits and one citrangequat tree 445 fruits.

VEGETABLES

Sweet Potatoes—The varietal tests, started in 1927 have been continued. The yields for 1931 were unusually low, which, if combined with those of previous years, would make very low averages. However, the growers should continue to plant the standard varieties, Porto Rico and Nancy Hall.

Irish Potatoes—The results of the test comparing the yielding ability of northern and local grown seed are given in Station Circular No. 85 and show beyond question the superiority of northern grown seed. Copies of this circular may be obtained by writing to the Director, Agricultural Experiment Station, A. and M. College, Mississippi, or to the South Mississippi Substation, Poplarville, Mississippi.

Melons—The test of several varieties of watermelons, started a few years ago, has been continued this year. The results show that the varieties Wonder and Stone Mountain produced the greatest total yield. Furthermore, these varieties possess high quality and good shipping ability. They enjoy great popularity where known. They can be recommended without hesitation to growers in South Mississippi.

Table 24—Yields of Various Watermelon Varieties—1930-31

Name	No. melons per acre	Weight largest melon	Av. wt. per melon	First melons shipped 1931	Rind	Remarks Flesh
Halbert Honey	1195	30.5	17.3	July 18	Thin	Sweet, tender
Stone Mountain	1803	25.5	21.5	July 10	Medium	Tender, good quality
Kleckley Sweet	1563	32.5	17.3	July 10	Thin	Tender, medium quality
New Schochler	711	48.5	29.0	July 23	Thick	Tender, medium quality
Thurmond Gray	1108	41.0	23.4	July 23	Thick	Firm, medium quality
Tom Watson	1449	43.0	18.1	July 23	Medium	Tender, firm, poor
Wonder	2047	39.0	19.9	July 10	Medium	Tender, good quality
"Monroe"	1118	47.0	32.2	July 10	Medium	Tender, good quality
Augusta Rattlesnake	1711	23.5	18.2	July 23	Thick	Tough, poor quality.
"Floribama" 1	941	40.0	18.6			
"Boyd Stewart" 2	832	37.0	21.3			

NOTE:

1. 1931 only—raised from seed secured from melon bought in Monroe, Louisiana.
2. 1930 only—locally grown sort.

WORK ON COMMERCIAL FERTILIZERS WITH SNAP BEANS, IRISH POTATOES, AND TOMATOES

As in past years, various fertilizer combinations were compared with the standard 4-8-4 mixture. The land was prepared for planting February 19 and the fertilizer application of 1600 pounds per acre, unless otherwise stated, made the following day. Certified Wisconsin Triumph potatoes were planted twelve inches apart in three-foot rows February 20. Giant Stringless snap beans were planted in eighteen-inch rows March 16, and Marglobe tomatoes were planted in four-foot rows eighteen inches in the drill April 16. The tomatoes were pruned according to the single stem system and staked. No topping was practiced.

Table 25—Effect of various fertilizer treatments on yields of beans, potatoes and tomatoes compared with that of a standard 4-8-4 treatment measured in net gain or loss in dollars per acre—1931

Treatment	Dollars Gain or Loss Per Acre		
	Beans	Irish Potatoes	Tomatoes
4-8-0	4.37	-9.00	117.69
4-8-2		11.29	
4-8-6		1.23	
4-8-8	24.13	3.39	15.45
4-8-12	-12.00		79.26
	-46.90	-6.79	-303.56
6-8-4	10.38	-7.26	-167.90
8-8-4	-17.34	-5.96	-72.04
10-8-4	-59.78	-11.66	-94.50
12-8-4	-99.24		-48.54
4-4-4		-8.99	
4-6-4		12.25	
4-8-4 *1		12.89	
Manure *2	-100.10		
15-30-15 *3	-85.88		-122.96

*1—1600 pounds per acre

*2—10 tons per acre

*3—375 pounds per acre

The results presented in Table 25 show the net gain or loss in dollars per acre of the various treatments compared to the standard 4-8-4 fertilizer. With increased applications of nitrogen above six per cent the yield of beans decreased. Furthermore, differences were observed in growth characteristics. Plants receiving high nitrogen possessed deep green thick foliage and short pods of poor quality. Growers should learn to correlate type of growth with size and quality of yield. Vigorous vegetative growth should be avoided. Growers should continue to use the standard 4-8-4 mixture or fertilizer with a 1-2-1 ratio until other ratios are found to be superior to it for South Mississippi.

Roses—Continued observations have been made of the twenty-four varieties of bush roses planted three years ago. Since these roses are growing on their own roots, many of them lack the necessary vigor of growth to produce satisfactory crops. Apparently these varieties should be established on one of the strong-rooted stocks if best results are to be obtained. Table 26 summarizes the results for 1930 and 1931.

Table 26—Yields of Various Rose Varieties—1930-31

Name	Average Number of Blooms Per Bush								Total
	April	May	June	July	August	Sept.	Oct.	Nov.	
Wellfleet	17	9	7	8	3	7	4	5	60
Wm. Shreve	4	7	4	7	3	8	6	2	41
Antoine Revoire	8	4	4	8	1	4	5	2	29
White Killarney	1	1	1	1	1	1	4	2	12
Erie De France	5	5	6	1	3	6	3	4	33
White Ochet	4	12	4	3	2	4	4	4	36
Duchess De Brabant	3	12	14	4	3	7	9	2	54
Bridesmaid	6	9	9	6	7	8	5	5	55
Mrs. Chas. Bell	13	14	6	3	1	3	1	1	42
American Beauty	12	11	7	1	1	3	6	3	44
Souvenir De Malmaison	3	6	4	3	2	3	2	5	28
Segong Weber	11	5	2	1	0	3	3	2	27
Columbia	14	5	4	1	1	2	3	2	32
P. W. Dunlop	6	6	2	1	0	3	1	3	22
Madame Butterfly	10	4	4	1	2	5	3	4	33
La France	12	8	8	3	1	5	2	3	43
Mrs. B. R. Cant	11	17	15	4	4	10	14	7	82
J. L. Meek	6	5	4	2	1	5	4	4	31
Golden Ophelia	2	7	4	1	1	3	2	3	23
Paul Heyron	11	13	7	4	1	3	2	3	44
Souvenir De Claudius Pernet	1	3	3	1	1	1	1	0	11
Ophelia	7	5	5	2	3	8	4	9	43
Marie Van Houtte	13	24	12	8	8	6	5	7	73
Wm. R. Smith	3	8	3	3	1	2	2	2	24

Ornamentals—The fifty different ornamental shrubs and trees growing in the landscape planting on the station grounds are being closely observed to obtain information on which recommendations may be made. Although this station does not furnish the services of a landscape architect, advice is given on the adaptability and general uses of, as well as on methods of pruning for, most ornamentals which should be planted about homes and public grounds in Mississippi.

SUMMARY

The winter cover crops which have shown special merit are: hairy vetch, Austrian winter pea, monantha vetch, pearl vetch, black medic, and crimson clover. Experiments were conducted on the effect of winter cover crops and commercial fertilizers on cotton wilt. Wilt infestation was higher on the plots which grew the cover crops than it was on the other plots.

A balanced commercial fertilizer seemed to have a depressing effect on cotton wilt; but there is not a direct relationship between wilt infestation and the total yield of cotton. Apparently boll-weevil injury is partially responsible for the results.

In the results given, dried blood, fish scrap, tankage, and calcium nitrate are of approximately equal value as a source of nitrogen under cotton. An average of seven cooperative nitrogen and potash analysis tests shows no advantage of increasing the nitrogen and potash above 32 pounds per acre. Potash applied as a side dressing at the rates of 16, 32, and 48 pounds of potash per acre shows a slight increase in one test on the Boyd Smith field, but another test on the same field showed no increase from side dressing with potash.

The data submitted show home-mixed and factory-mixed fertilizers are of approximately equal value. The same is true of high analysis and low analysis fertilizers when compared on basis of actual plant food carried.

In the Main Cotton Variety Test, Stonevill 3, Delfos 531, Lightning Express 8, Stoneville 2, and D. & P. L. 10 are the five highest yielding varieties in the order named. In five-year average, the five leading varieties are Missdel 2, Express, Cleveland 54, Wilson Type, and D. & P. L. 4-8 respectively.

A five-year average of corn varieties gives highest yields for Mexican June, Coker's Prolific, Station Mosby Hastings, and Laguna in the order named. Four varieties of sugar cane, P. O. J. 213, Cayana, C. P. 897, and C. O. 290, show outstanding value.

As money crops in South Mississippi, peanuts and the tung oil tree show considerable promise.

Heavy pruning gave better results than light pruning in rejuvenating a 10-year old Early Rose peach orchard when 12 pounds of 4-8-4 fertilizer was used per tree.

The Stuart, the Success, and the Schley are the three leading varieties in a test of 12 varieties of pecans.

While the Delaware grape, is the most desirable for table use, the Delicious, Herbemont, Lenoir, Muench, Flowers, Scuppernong, and Thomas are promising for juice and jelly making.

Under mulch culture, the Lemon and Celeste varieties of fig produced fruit almost twice the size that they did under clean culture.

Three cold-resistant satsuma orange trees produced an average of 261 fruits, while 14 of the cold-susceptible trees produced an average of 48 fruits after a minimum temperature of 16°F. in the winter of 1929-30. One lemon and one citrangequat tree withstood the cold favorably and produced 52 and 445 fruits respectively.

In a variety test, the Wonder and Stone Mountain waterlemons not only produced the greatest yield but also possessed high quality and good shipping ability.

The results of a fertilizer test with snap beans, Irish potatoes, and tomatoes show the standard 4-8-4 mixture or a 1-2-1 ratio to be the best fertilizer for vegetables for general use in South Mississippi.

In a test of 24 varieties of bush roses, Mrs. B. R. Cant, Marie Van Houtte, and Wellesley are the leading varieties judged by the number of roses per bush.

1000 1000 1000

Making Cotton Cheaper

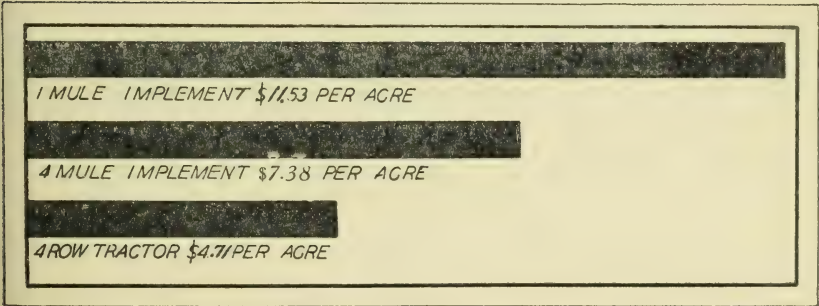
Can Present Production Costs Be Reduced?

(Supplement to Bulletin 290)

DELTA EXPERIMENT STATION

Stoneville, Mississippi

M. G. Vaiden, J. O. Smith, W. E. Ayres



Graphic illustration of variable per acre cotton production costs—Three year averages in Delta Station tests. For detailed data see table seven.

MISSISSIPPI AGRICULTURAL EXPERIMENT STATIONS
State College, Mississippi
W. R. PERKINS, Director

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Summary

Cotton production cost records herein published should be studied along with those in Mississippi Stations Bulletin No. 290. They were materially reduced in 1931 but were still relatively too high on the average to permit profits. Further reductions will be made in 1932 but there is a minimum below which reduction is not possible.

Labor costs are more variable than other items. For this reason costs on plantations using small units of equipment and excessive amounts of labor are much more variable than where maximum use is made of machinery and labor requirements reduced to a minimum.

Fifteen-acre-per-family units can never again be profitable on the average, even in the Delta. Neither labor nor operator will ever be satisfied again with living standards possible under a system requiring so much overhead and the support of so many human beings per unit area. Human demands will continue to exceed possible income. Part of the power now supplied by man must be replaced by mules and machines which are less expensive per unit of power.

No other items were reduced so much in 1931 as tenant charges but because of the human factor these will be the first to rise when business revives. Farm labor's daily income is still below that of industrial labor. Only farm machines and power can equalize it. Farm labor must do more work per family else farms cannot compete with industry for labor. Industries have mechanized in self defense as the farms must do as rapidly as possible. From 30 to 50% of present Delta farm labor must ultimately be replaced by machinery if plantations are to escape foreclosure.

The production of farm necessities at home materially reduced operating costs in 1931. This can be continued and increased. The home production of feed is now economical and safe in the Delta. Food production can probably be made much more economical through the use of commercial type storage machinery and methods for meats, fruits, and vegetables which can be economically produced on Delta plantations.

Plantation accounts should be so kept and analyzed that operators can separate profitable and unprofitable expenditures and eliminate the latter. A way must be found to pay plantation labor after, rather than before, the labor is performed. (There are two bad paymasters. One pays in advance, the other never.) Radical reduction in labor population offers one partial means of escape.

Putting labor on a cash or day basis will increase its efficiency 50 to 100%.

As cultivating machinery is improved, more hoeing can be eliminated by cross plowing. Cotton chopping machines will also assist. Soil enrichment will make checked (either check-planted or plowed into checks) cotton compete in production with drilled cotton, thereby eliminating more hoeing.

Mechanical harvesting equipment can easily reduce operating labor 75% from one-mule-methods requirements. This will materially reduce housing, supervision, and other overhead and make cotton production profitable.

Pickers and strippers have been wonderfully improved in the past year. Their perfection to the point of commercial production and economical use is a matter of only a very few years. Their production and use will make possible maximum, economical use of much more production machinery and will greatly accelerate its improvement.

The South will not retrograde. Machine production will be rapidly increased in cotton growing as it has in the industries. Planters should accelerate their present evolution in the direction of labor replacement by practical, economical farm machines now available.

MAKING COTTON CHEAPER

Can Present Production Costs Be Reduced?

M. G. Vaiden, J. O. Smith, W. E. Ayres

During both 1930 and 1931 production cost records have been kept on ten Delta plantations in the hope that ways and means of more economical production might be found. Records for 1930 were published a year ago as Bulletin No. 290, which is still available. The same methods were used in 1931 as in 1930. General statements contained in Bulletin 290 apply to this publication.

All data indicate that, though production costs were reduced in 1931 and will certainly be reduced further in 1932, the per family acreage must be increased if cotton production (or Southern farm production, for that matter) continues to compete with American industry for labor. Farmers must produce more farm necessities at home and farm labor be thereby enabled to work a higher percentage of the time.

Delta lands ill-adapted to cotton may profitably grow feed and food crops. With the development of economical methods of artificial forage crops drying there will come, in the Delta, a feed crops industry second to none on any like area. Where feed is abundantly and economically grown livestock production often develops.

For many reasons production costs in the Delta have been excessive. These have all but "sunk the cotton production boat." In 1930 advances to tenants on five plantations averaged \$30.00 per cotton acre, and the average total operating expense was more than \$40.00 per acre. Cheap cotton brought the realization that cotton could pay no such expense together with an average necessary additional charge of more than \$20.00 per acre for administration and other fixed overhead.

Table 1 gives detailed expenses of operating the same 5 plantations in 1931 as are given in table 1, page 9 of Bulletin 290 for 1930.

Table 1-A shows what determined efforts to reduce expenses can accomplish in one year. Plantation No. 1 reduced its tenant charges from \$47.42 per cotton acre in 1930 to \$22.03 in 1931, or a reduction of 53.5%. Plantation No. 5 reduced its tenant charge 42.6% and No. 2, 33.6%. Plantations 3 and 4 did not reduce their tenant charges but made worthwhile reductions in other items of expense. The average reduction in tenant charges for the 5 plantations was \$9.99 per cotton acre or 33.3%. For the three plantations which did all the reducing of tenant charges the average was \$16.88 per cotton acre or 43.0%.

No other items of expense have been reduced so much, on the average, as tenant charges, nor can they be, for the reason that they have never been so unnecessarily and unreasonably high. Cotton planting cannot be profitable so long as total expenses are more than \$46.00 per acre and gross proceeds from \$30.00 to \$40.00. The day is not yet that the "little" pot will contain the "big" one.

Tenant expenses can be further reduced through the use of two-row implements and increased acreage per family. This is being done quite satisfactorily by some Delta planters. This, of course, complicates picking problems. The old idea of "deadbeating" will continue to prevail, so long as any class of labor is paid in advance, which has ever been the practice with the present tenant system.

Table 2 shows that in 1931, as in 1930, quarter-hand charges were much greater than when half-hands were used. The difference in 1931 was \$14.29 per cotton acre or practically 100% more. Risks have never been greater than

now on tenant advances. Total tenant charges in 1931 were practically 50% more with quarter than with half hands. In general there is another additional risk with quarter hands because their workstock is usually very inferior and unable to properly prepare and cultivate their crops. Feed furnished their workstock is often used for other purposes and the workstock is half starved.

There is much comfort in production cost figures on plantation No. 5 in 1931 for those who are absolutely "wedded" to the tenant system. The total production cost of \$29.02 per cotton acre compares favorably with the average of \$29.37, Table 4, on the five tractor operated plantations. It is proof, positive, that production costs can be held within plantation income.

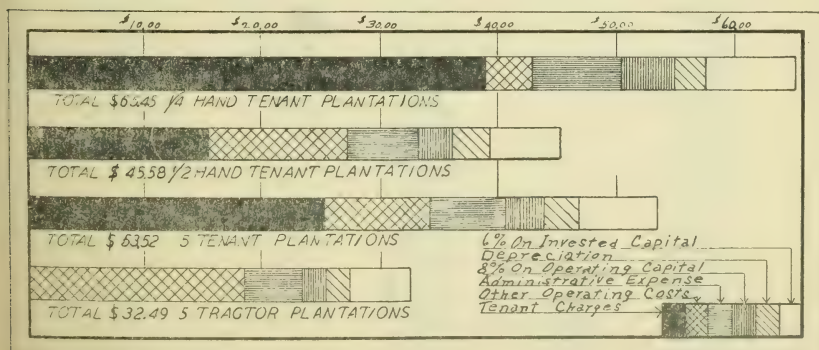
TABLE 1—Actual Per Acre Cost of Operation Using Different Tenant Systems In Cotton Production

Line No.	ITEMS CHARGED	Part of Crop Retained by Landlord and Plantation Number					Average Five Plantations	
		1/4	1/4	1/2	1/2	1/2	1931	1930 and 1931
		1	2	3	4	5		
	Tenant Charges							
1	Cash crop advances -----	\$.41	\$ 1.40	\$.06	\$.03	\$ 2.62	\$.90	\$ 6.19
2	Moving expense -----					.08	.02	.06
3	Merchandise -----	9.55	19.89	8.00	10.10	2.87	10.08	7.58
4	Doctor and drugs -----	1.49	.03	.46	.41	.26	.53	.70
5	Feed -----	3.25	6.59	—	.46	—	2.06	2.84
6	Land rented to tenants -----	2.29	1.68	—	.91	—	.97	.82
7	Cotton seed -----	.90	1.18	—	.08	—	.43	.69
8	Fertilizers -----	1.05	—	1.78	.01	—	.57	1.88
9	Shop work -----	.26	.08	—	.02	—	.07	.06
10	Infestation expense -----	—	—	—	—	—	—	.11
11	Extra labor for crops -----	.06	.30	1.73	1.60	.09	.76	1.12
12	Live stock sales -----	—	—	—	—	—	—	.54
13	Harvesting help -----	2.77	3.95	4.09	3.19	4.09	3.62	2.41
14	Total tenant charges -----	22.03	35.10	16.12	16.81	10.01	20.01	25.00
	Other Necessary Costs							
15	Ditches, roads, fences, shop -----	.27	—	1.21	1.24	1.94	.93	1.24
16	House repairs -----	.16	—	.24	1.03	.13	.31	.52
17	Feed and barn expense -----	2.52	—	6.31	6.11	2.36	3.46	3.28
18	Fertilizers -----	1.50	—	1.18	.01	—	.54	1.27
19	Cotton seed -----	.27	—	.69	.91	1.23	.62	.82
20	Hay crops -----	.88	.25	1.43	2.04	.99	1.12	1.04
21	Corn crops -----	.65	—	—	.26	—	.18	.23
22	Sundry supplies -----	.12	—	.07	.29	—	.10	.16
23	Misc. extra labor -----	.38	—	.08	.57	.47	.30	.28
24	Total operating expense not charged tenant -----	6.75	.25	11.21	12.46	7.12	7.56	8.84
25	Total operating expense -----	28.78	35.35	27.33	29.27	17.13	27.57	33.84
	Administration							
26	Mgrs., bkkprs. & office -----	2.31	2.67	3.83	5.15	1.93	3.18	3.28
27	Insurance -----	.24	.54	.27	.35	.12	.31	.32
28	Taxes -----	2.88	3.61	2.51	3.07	2.95	3.00	2.98
29	Total administration -----	5.43	6.82	6.61	8.57	5.00	6.49	6.58
30	Total adm. & opr. exp. -----	34.21	42.17	33.94	37.84	22.13	34.06	40.42
31	8% on adm. & opr. exp. -----	2.75	3.37	2.72	3.03	1.77	2.73	3.33
32	Depreciation -----	3.41	2.64	2.68	3.62	1.94	2.86	3.02
33	6% on invested capital -----	9.45	7.82	5.94	7.84	3.18	6.84	6.75
34	Total production cost -----	49.82	56.00	45.28	52.33	29.02	46.49	53.52

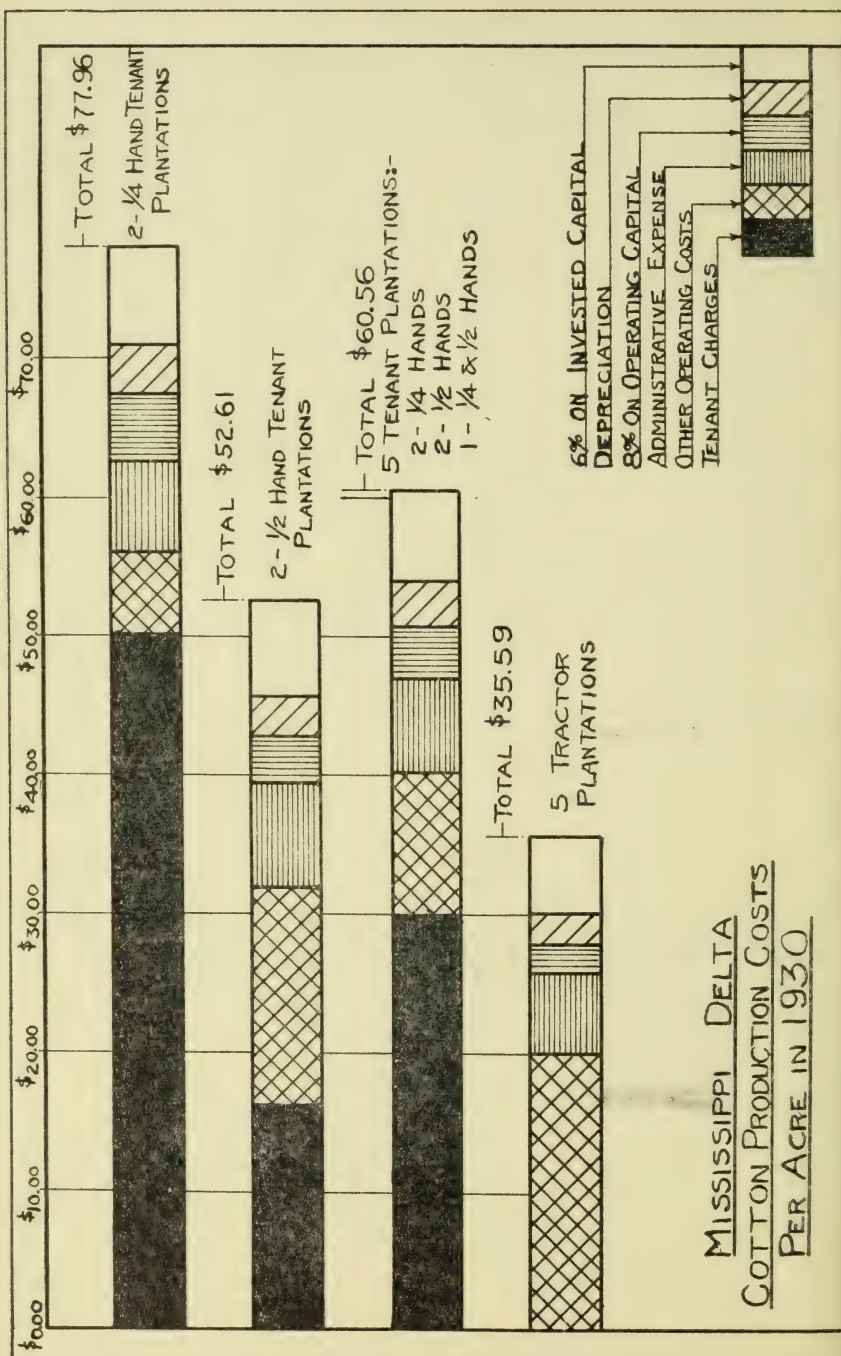
ALL COSTS BASED ON COTTON ACREAGE

**TABLE 1-A—Tenant Operations of 1930 and 1931 Compared in
Dollars of Expense Per Cotton Acre**

EXPENSE ITEMS	Pltn No.	1930	1931	Decreases of 1931	
				Dollars	Percent
Tenant Charges -----	1	\$47.42	\$22.03	\$25.39	53.5
Other Nec. costs -----	1	7.19	6.75	.44	4.7
Administration, Etc. -----	1	7.66	5.43	2.23	29.1
Total Production cost -----	1	78.86	49.82	29.04	36.8
Tenant Charges -----	2	52.90	35.10	17.80	33.6
Other Nec. costs -----	2	3.70	.25	3.45	93.2
Administration, Etc. -----	2	5.59	6.82	— .23	— 1.8
Total Production cost -----	2	77.07	56.00	21.07	27.3
Tenant Charges -----	3	15.87	16.12	— .25	— 1.5
Other Nec. costs -----	3	16.06	11.21	4.85	30.2
Administration, Etc. -----	3	6.79	6.61	.18	2.7
Total Production cost -----	3	51.01	45.28	5.73	11.2
Tenant Charges -----	4	16.40	16.81	— .41	— 2.4
Other Nec. costs -----	4	15.24	12.46	2.78	18.2
Administration, Etc. -----	4	8.35	8.57	— .22	— 2.6
Total Production cost -----	4	54.21	52.33	1.88	3.5
Tenant Charges -----	5	17.46	10.01	7.45	42.6
Other Nec. costs -----	5	8.32	7.12	1.20	14.4
Administration, Etc. -----	5	4.93	5.00	— .07	— 1.4
Total Production cost -----	5	41.65	29.02	12.63	30.3
Tenant Charges -----	Avg.	30.00	20.01	9.99	33.3
Other Nec. costs -----	Avg.	10.11	7.56	2.55	25.2
Administration, Etc. -----	Avg.	6.67	6.49	.18	2.7
Total Production cost -----	Avg.	60.56	46.49	14.07	23.2



Yazoo-Mississippi Delta production costs, average 1930 and 1931, when different systems of growing cotton were used. For detailed data see tables two and four.



A comparison of the cropping system and feed purchases of the plantations operated with tenants in 1930 and 1931 accounts, in part, for the high cotton production costs in 1931. In 1930 72.9% of the average total plantation acreage was planted to cotton. Little feed was planted and the extremely dry summer prevented normal production on the acreage devoted to feed. As a consequence feed for the 1931 crop was an important part of production costs. Feed crops expense in 1931 was also heavy and feed production good. The 1931 crop was charged, therefore, with feed for two crops. The feed expense in 1932 will be limited, largely, to feed production for 1933. Mule power will compete, nearer on an equal basis, with mechanical power in cotton production the current year. Charging feed for two years against one year's cotton

TABLE 2—Average Per Acre Cost of Operation Using Different Tenant Systems in Cotton Production

Line No.	ITEMS CHARGED	Part of Crop Retained by Landlord, and Plantation No.		Average Five Plantations	
				1931	1930 and 1931
		1/4	1/2		
		1 & 2	3, 4 & 5		
	Tenant Charges				
1	Cash crop advances -----	\$.90	\$.90	\$.90	\$ 6.19
2	Moving expense -----	—	.02	.02	.06
3	Merchandise -----	14.77	6.99	10.08	7.58
4	Doctor and drugs -----	.76	.38	.53	.70
5	Feed -----	4.92	.16	2.06	2.84
6	Land rented to tenants -----	1.98	.30	.97	.82
7	Cotton seed -----	1.04	.03	.43	.69
8	Fertilizers -----	.52	.59	.57	1.88
9	Shop work -----	.17	.01	.07	.06
10	Infestation expense -----	—	—	—	.11
11	Extra labor for crops -----	.18	1.14	.76	1.12
12	Livestock sales -----	—	—	—	.54
13	Harvesting help -----	3.36	3.79	3.62	2.41
14	Total tenant charges -----	28.60	14.31	20.01	25.00
	Other Necessary Costs				
15	Ditches, roads, shop -----	.13	1.47	.93	1.24
16	House repairs -----	.08	.47	.31	.52
17	Feed and barn expense -----	1.26	4.93	3.46	3.28
18	Fertilizers -----	.75	.40	.54	1.27
19	Cotton seed -----	.13	.95	.62	.82
20	Hay crops -----	.56	1.49	1.12	1.04
21	Corn crops -----	.32	.09	.18	.23
22	Sundry supplies -----	.06	.09	.10	.16
23	Misc. extra labor -----	.19	.37	.30	.28
24	Total oper. exp. not chg. to tenants -----	3.50	10.26	7.56	8.84
25	Total operating expense -----	32.10	24.57	27.57	33.84
	Administration				
26	Mgr., bkkprs., and office -----	2.49	3.64	3.18	3.28
27	Insurance -----	.39	.24	.31	.32
28	Taxes -----	3.24	2.84	3.00	2.98
29	Total administration -----	6.12	6.72	6.49	6.58
30	Total adm. & opr. expense -----	38.22	31.29	34.06	40.42
31	8% on adm. & opr. expense -----	3.06	2.52	2.73	3.33
32	Depreciation -----	3.02	2.75	2.86	3.02
33	6% on invested capital -----	8.62	5.65	6.84	6.75
34	Total production cost -----	52.93	42.21	46.49	53.52

ALL COSTS BASED ON COTTON ACREAGE

acreage, which in 1931 was only 63.1% of the average total plantation acreage, makes the comparison of tenant and mechanical operation unfair. Comparisons in 1932 will be very interesting.

TABLE 3—The Cropping System on the 5 Tenant Operated Plantations 1931

Plan- ta- tion No.	No. of Cab- ins	Percentage of Total Acreage Used For							
		Cotton	Corn	Hay	Other Feed	Woods	Ditches Roads	House Sites	Pas- ture
1	75	64.4	11.2	—	13.7	3.8	1.9	3.8	1.2
2	21	62.8	19.8	6.6	4.4	—	1.8	4.4	.2
3	43	71.4	.9	—	13.9	.9	6.0	6.0	.9
4	44	53.6	6.4	2.6	10.9	17.6	3.3	5.6	—
5	27	69.6	5.3	3.0	6.6	6.0	6.1	1.6	1.8
Avg.	42	63.1	9.5	2.5	10.4	5.5	3.5	4.5	1.0

TABLE 4—Actual Per Acre Cost of Operation Using Tractor System in Cotton Production

Line No.	ITEMS CHARGED	PLANTATION NUMBER					Average Five Plantations	
							1931	1930 and 1931
		6	7	8	9*	10*		
	Operating Costs							
1	Preparing land -----	\$ 1.14	\$ 1.44	\$ 1.27	\$ 1.38	\$.91	\$ 1.33	\$ 1.72
2	Planting cotton -----	.40	.53	.77	.32	.16	.44	.75
3	Chopping cotton -----	1.32	1.52	2.63	2.87	3.54	2.38	2.53
4	Cultivation -----	.62	3.13	2.18	1.63	.83	1.74	1.81
5	Applying fertilizers -----	.10	.19	.26	—	.08	.13	.27
6	Infestation expense -----	—	.01	—	—	1.40	.29	.31
7	Misc. payroll & exp. -----	.05	.14	.11	—	.36	.14	.08
8	Ditches, roads, etc. -----	.34	.06	.32	.12	.15	.18	.42
9	House repairs -----	.01	.03	—	—	—	.01	.05
10	Tractor and imp. rprs. -----	2.22	1.53	.91	.98	.23	1.14	1.15
11	Feed and hostler -----	.08	—	—	—	—	.02	.07
12	Cotton harvesting -----	3.87	7.39	4.59	6.59	4.93	5.48	4.98
13	Fertilizers -----	2.61	2.80	2.57	—	3.09	2.23	3.04
14	Cotton seed -----	1.02	.45	.61	.80	1.81	.94	1.01
15	Total operating cost -----	14.07	19.08	16.42	15.19	17.49	16.45	18.19
	Administration							
16	Mfrs. bkkpr. & office -----	2.57	2.18	3.66	1.76	1.75	2.37	2.49
17	Taxes -----	2.28	2.81	3.56	3.32	2.98	2.99	3.09
18	Insurance -----	.69	—	—	—	—	.02	.03
19	Total adm. expense -----	4.94	4.99	7.22	5.02	4.73	5.38	5.61
20	Total adm. & opr. exp. -----	19.01	24.07	23.64	20.21	22.22	21.83	23.80
21	8% on adm. & opr. exp. -----	1.52	1.93	1.89	1.62	1.79	1.75	1.91
22	Depreciation -----	1.78	1.83	1.70	.87	1.11	1.47	1.81
23	6% on invested capital -----	1.10	5.03	4.58	3.34	4.25	4.32	4.97
24	Total production exp. -----	26.41	32.86	31.90	26.34	29.36	29.37	32.49

*Not the same as Nos. 9 and 10 in 1930

ALL COSTS BASED ON COTTON ACREAGE

Operating costs on five tractor-operated plantations in 1931 average \$16.45 per cotton acre. This is \$11.12 less than the per cotton acre cost of operation on the five tenant-operated plantations, or a difference of 40%. It is \$0.68 per cotton acre less than the cheapest tenant operation. The cheapest tenant-operator spent only \$3.06 per cotton acre, or 21.7% more, for actual operation in 1931 than the cheapest tractor-operator. In 1930 this difference was \$13.07 per cotton acre or 102.8%. Operating expenses on the three tractor plantations which were the same in 1930 and 1931 were an average of \$4.77 per cotton acre or 28.9% more in 1930 than 1931.

Table 7 gives production cost records at the Delta Station for three years. In 1930 Station records on 4 row tractor equipment differed from the average of the 5 tractor operated plantations by only 22 cents per acre on the same items of expense. In 1931 this difference was only 11 cents per acre.

That the cost of tenant operation is more variable than tractor operation is evident. This will be true so long as labor population is excessive and tenant labor is paid in advance because labor "runs" the plantations in "good times" and the owners "run" them during depressions. The replacement of non-essential labor with tractors, 4-mule cultivators, or other large mechanical units tends to stabilize operation at lower cost and to enable retained farm labor to earn a better living.

Reduction of the farm labor population 30 to 50% is essential to "decent" living standards on the farm. Soap box orators may decry cotton pickers, tractors, two and four-mule machinery but they and other modern farm machines are just as essential to farmers who expect to earn decent livings and fair returns on investments as are linotypes to printers, compressed air and concrete mixing machines to contractors, modern spinning and weaving machines to textile manufacturers, or modern equipment to other American industries. True enough, up-to-date farm equipment reduces the man-power necessary. So does all modern machinery. But Americans will not go backward. It is not up to American farms to absorb, even at pauper wages, either the labor released from modernized industry or non-essential farm-labor replaced by the economical use of adapted farm machines. American genius must find other fields for replaced labor both from modernized farms and industry if peasantry is to be avoided.

Some planters maintain that tractor operation is cheaper but that mules and tenants produce more per acre. The Station is only interested in lowering unit production costs. If this can be done with larger mule units and fewer tenants (fewer mouths to feed and other wants to satisfy) well enough, but the Delta must find ways and means of continuously producing cotton cheaper, relatively, than in the past.

TABLE 5—The Cropping Systems on the 5 Tractor Operated Plantations

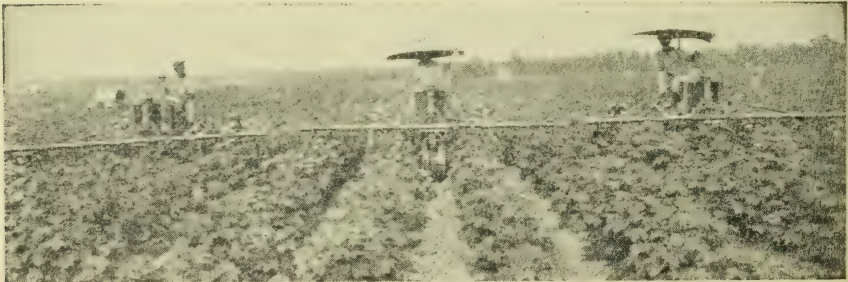
Plan- ta- tion No.	No. of Cab- ins	Percentage of Total Acreage Used For						
		Cotton	Hay Corn	Idle Land	Woods	Ditches Roads	House Sites	Pas- ture
6	4	84.1	—	—	13.4	1.4	.1	—
7	5	97.0	—	—	—	1.9	1.1	—
8	8	71.0	—	—	22.4	5.1	1.5	—
9	10	85.9	—	—	11.3	2.3	.6	—
10	5	70.3	—	—	24.3	4.9	.5	—
Avg.	6.2	84.9	—	—	12.2	2.4	.7	—



Seven 2-mule cultivators do as much cultivating and do it as well as 14 one-mule implements and save 7 men.



14 mules and 4 men with 2-row cultivators cover nearly as much ground as 14 men and 14 mules with one-mule outfits, or 7 men and 14 mules with 2-mule cultivators.



3 men and 3 tractors with 4-row cultivators do still more work, even while the crop is small, than 14 men and 14 mules with one-mule units and more than twice as much after the cotton is large enough to permit running in second gear. This may look revolutionary but it is the simple evolution which has taken place in the Yazoo-Mississippi Delta in the last 10 years.

Stars are invisible when the sun is shining but darkness brings them out. The competition of industry for labor and labor's demands for better living conditions will ultimately force planters to see the necessity for more and more machinery in cotton production. Poor land is unprofitable in any cultivated crop. The thin acres must be built up through the use of legumes or fertilized to produce economically. Both intensive and extensive methods must be employed in reducing costs. Per acre production must be considered and kept up.

Insufficient knowledge of just where operation "leaks" are is responsible for a high percentage of Delta cotton plantation losses. Every average sized Delta plantation can afford the expense necessary to keep sufficient records to be able to trace losses and stop them. With such records unprofitable expenditures can be adjusted or eliminated and production costs reduced thereby.

There is an irreducible minimum below which production costs cannot be economically reduced. Available funds wisely spent in operation often pay dividends far in excess of the risk taken. The cheapest operation is not necessarily the most profitable but it is essential that plantation production expenses be kept below the gross value of the crops grown.

Good crops, high prices, and scarcity of labor led operators into the bad habit of investing from \$50.00 to \$250.00 in tenant families when they moved on the place and before a furrow was run. Tenants often owe more than \$10.00 per cotton acre before the crop is planted.

By many, the "furnish" is considered the largest expense item. A study of plantation books for the past ten years will convince that food and clothing expense for tenants is small compared with combined expenditures for extra labor for chopping, plowing, picking, moving expense, payment of old accounts to prior landlord, Christmas money, cash out of which the average tenant will argue the "boss," doctor bills, etc. So much of this is paid in advance that there is little incentive for tenants to work. Many planters have literally given their plantations to tenants for unfulfilled promises to work. The one way of escape is through greatly reduced labor population.

Machines are already available which will satisfactorily eliminate a high percentage of previously-considered-necessary plow-cultivation labor. Satisfactory one-row cotton choppers are available which will most surely be converted to operate with two and four row cultivating units. Fields can be cross-plowed to eliminate the first chopping. Check-row cotton produces satisfactory yields on fertile soils and eliminates 60 to 80% of the hoe labor. Cross plow-

TABLE 6—Comparison of Per Acre Cost of Operations of Various Systems Used in Cotton Production—1931 and 2 Year Average

ITEMS CHARGED	Part of Crop Retained by Landlord and Plantation Number					
	$\frac{1}{4}$	$\frac{1}{2}$	Avg.	Tractor	Tenant	Tractor
	1 & 2	3, 4 & 5	1-5	System 6-10	2 yr. av. 1-5	2 yr. av. 6-10
Tenant Charges -----	28.60	14.31	20.01	—	25.00	—
Other operating costs -----	3.50	10.26	7.56	16.45	8.84	18.19
Administrative expense -----	6.12	6.72	6.49	5.38	6.58	5.61
8% on operating capital -----	3.06	2.52	2.73	1.75	3.33	1.91
Depreciation -----	3.02	2.75	2.86	1.47	3.02	1.81
6% on invested capital -----	8.63	5.65	6.84	4.32	6.75	4.97

ing can be done with power equipment with the hills 20 inches apart if the steering mechanism can be made absolutely positive. This will permit check-cultivation on thinner soils and will eliminate more hoe labor through more shade from the cotton crop.

Less available progress has been made in cotton harvesting machinery than in that for cotton production, but great advancement has been made in the former in the last ten years. Continuous improvements will be made. In 1931 five cotton picker manufacturers seriously worked with their machines in the Delta and other Southern fields, finding their weak and impractical points. Among these was the Gyracon Harvester of Geo. R. Meyer cord and Associates of Chicago, whose financial cooperation made these cost studies possible. The 1931 models showed much improvement over those of 1930. More improvement is expected in the next two years than for the past six or eight.

During the past much progress has been made in picking higher grades and higher percentages of the crop. Wheel traction has been improved on the self-contained machines but traction is unimportant for the reason that any of the picking mechanisms can be attached to crawler-type, or other tractors

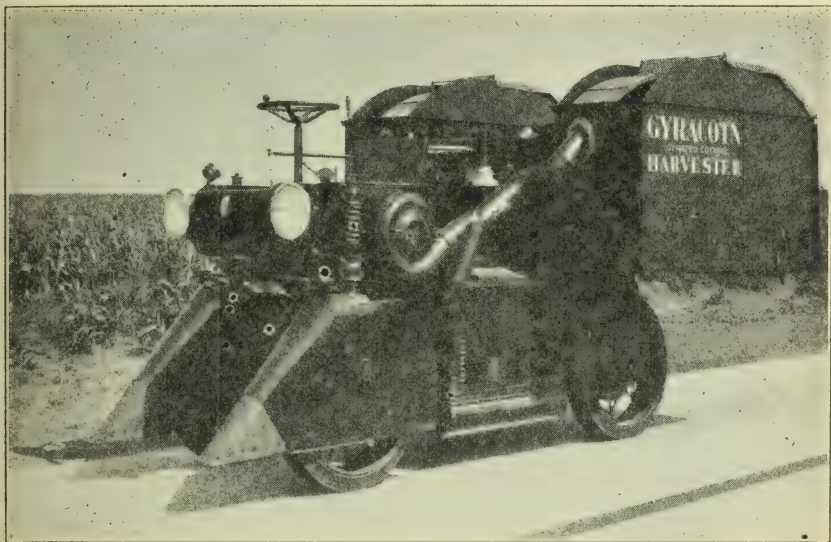
**TABLE 7—Cultivation Costs with Various Units of Equipment
1929-30-31 at the Delta Experiment Station**

Operations	Dollars Per Acre for Operations With Various Units of Equipment					
	½ Row or One Horse	1 Row or 2 Horse (1)	1 Row or 2 Horse (2)	2 Row or 4 Horse	2 Row Tractor	4 Row Tractor
Average for 1929 and 1930						
Breaking, cutting, or disking stalks	0.90	0.64	0.64	0.51	0.37	0.37
Preparing seed bed (disking, bedding and harrowing)	3.08	2.45	2.45	1.66	0.73	0.73
Distributing Fertilizer	0.61	0.48	0.48	0.48	0.46	0.42
Dragging and planting	0.64	0.50	0.50	0.50	0.52	0.48
7 Cultivations	7.86	6.28	5.70	4.96	4.54	3.24
Total for operations having variable cost	13.09	10.35	9.77	8.11	6.62	5.24
1931 (3)						
Breaking, cutting, or disking stalks	0.60	0.55	0.52	0.50	0.39	0.41
Preparing seed bed (disking, bedding and harrowing)	2.34	2.18	2.13	1.66	0.89	0.92
Distributing fertilizer	0.41	0.40	0.37	0.49	0.35	0.29
Dragging and planting	0.59	0.60	0.58	0.70	0.55	0.44
7 Cultivations	4.48	3.37	3.20	2.57	1.84	1.61
Total for operations having variable cost	8.42	7.10	6.80	5.92	4.02	3.67
3 Year Average						
Breaking, cutting or disking stalks	0.80	0.61	0.60	0.51	—	0.38
Preparing seed bed (disking, bedding and harrowing)	2.84	2.36	2.34	1.66	—	0.79
Distributing fertilizer	0.51	0.46	0.45	0.49	—	0.37
Dragging and planting	0.62	0.52	0.52	0.56	—	0.47
7 Cultivations	6.73	5.31	4.87	4.16	—	2.70
Total for operations having variable cost	11.53	9.26	8.78	7.38	—	4.71
Estimated No. acres per man	15	24	30	50	—	120

(1) Walking Cultivator. (2) Riding Cultivator. (3) 3-row tractor equipment used because 2-row is becoming obsolete in this section.

Production costs that were constant (fertilizer, hoeing and picking) for all equipment are not tabulated. The fertilizer was distributed with one, two, and four-row planters. In 1929 and 1930 man labor was figured at \$0.20 per hour; mules \$0.10; tractor and driver at \$0.65; when pulling 4-row cultivator, \$0.70. In 1931 man labor was figured at \$0.12½ per hour; mules, \$0.10; tractor and driver, when pulling 3-row equipment, \$0.55; 4-row equipment, \$0.60.

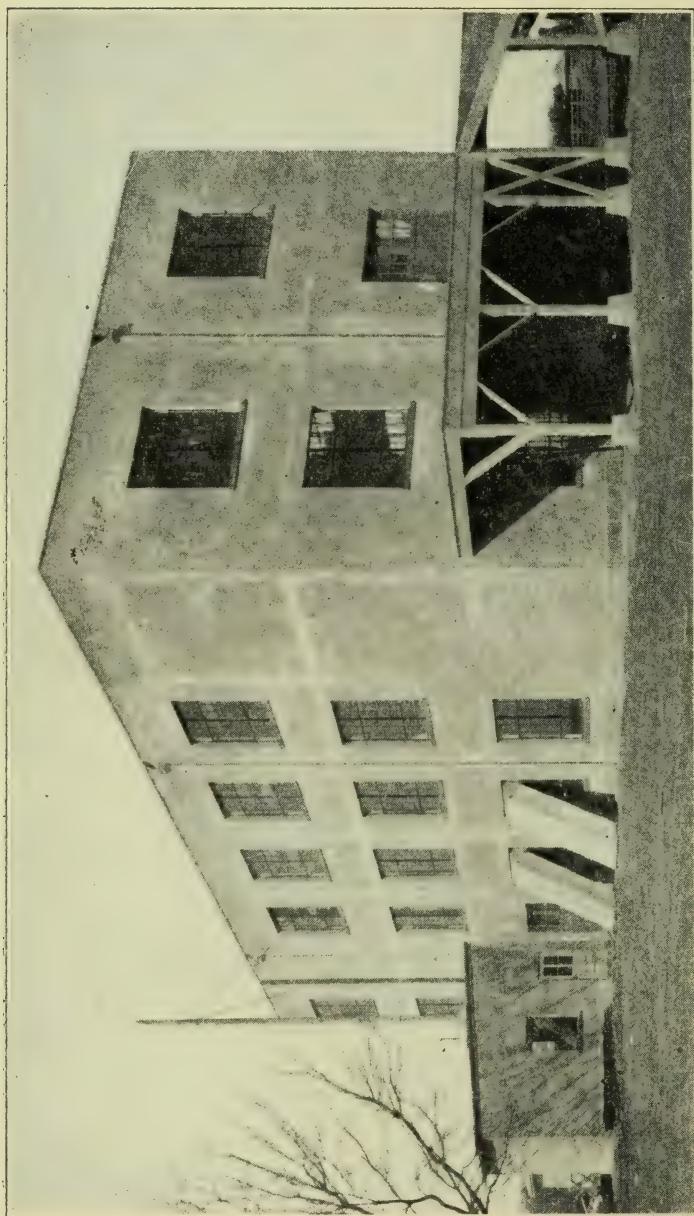
which have plenty of both power and traction. The outlook for mechanical harvesting equipment—pickers for early season work and good grades (for color) and strippers with which to economically finish the job—is very promising.



The Station expects commercial production of successful mechanical cotton pickers within the near future, followed by the use of much less hand labor in production as well as harvesting. Two or three cotton pickers are rapidly approaching practical, mechanical, usable perfection. Several others are under construction.



One hundred men and women picking Delta cotton, at Lombardy, Mississippi, April 5, 1932, which should have been picked previous to November 1, 1931. A minimum of 30% of the value of this thousand acres of cotton was lost due to delayed harvesting. Mechanical pickers will eliminate much if not most of such losses which cost Southern cotton growers millions annually.



Cotton Research Laboratory and Experimental Gin erected at the Delta Experiment Station in 1930 by the United States Department of Agriculture. Very valuable information is being collected here, by the Bureau of Agricultural Engineering and Agricultural Economics of the Department, on drying, cleaning, ginning, and fiber testing of cotton. Information obtained from thousands of these tests annually should enable ginners to leave in cotton all the value placed there by Mother Nature.

To many, the factor of waste with mechanical cotton harvesting equipment appears exceedingly large. Few appreciate that waste is not so great as it appears. Each lock dropped on the ground or left on the stalk is fluffed up, stringy, and more noticeable than ten which have fallen and been beaten into the ground by rains. First, the waste is much less than it appears. Second, improvements which will come from field experience will eliminate much if not most of present-day machine waste. Mechanical harvesting machinery may never do as nearly a perfect job as hand pickers. Lack of labor often means appalling losses both in weight and grade. Field losses in the Arkansas Delta on the 1918 cotton crop picked January 21st was 11.1% more than on the same standard varieties having 82% of the crop picked October 1st and the remainder a month later. The loss in total value was 33.6% (Arkansas Station Circular 47). Such losses in seasons of good weather as prevailed in late 1918 and early 1919 are much less than during bad seasons. Being usual, partially invisible, and seldom measured, little thought is given to such losses.

Grade figures are available on 1,476,800 bales of cotton for the 9 years, 1922-30. Of this baleage 2.14% was good middling; 15.97% strict middling; 30.04% middling; 26.55% strict low middling; 15.13% low middling; 4.57% strict good ordinary; 2.77% good ordinary; 2.07% strict ordinary, and 1.61% ordinary. The average was 1-6 of a grade above strict low middling. To avoid high percentages of low grades under present harvesting methods very large numbers of pickers are necessary.

When an abundance of mechanical harvesting equipment is available with which to harvest the crop as rapidly as it opens the color and intrinsic value can be maintained. Gin and mill machinery is already available which economically removes trash if mechanical equipment harvests cotton rougher than hand labor. The latter may or may not be true. It is entirely possible, and quite probable, that within a few years mechanically harvested crops may be intrinsically more valuable in the aggregate, than are similar hand-picked crops today, due primarily to the time factor which nowadays causes vast disregarded losses. Cotton picked by two different types of mechanical pickers well distributed over the belt in the fall of 1931 averaged above low middling.

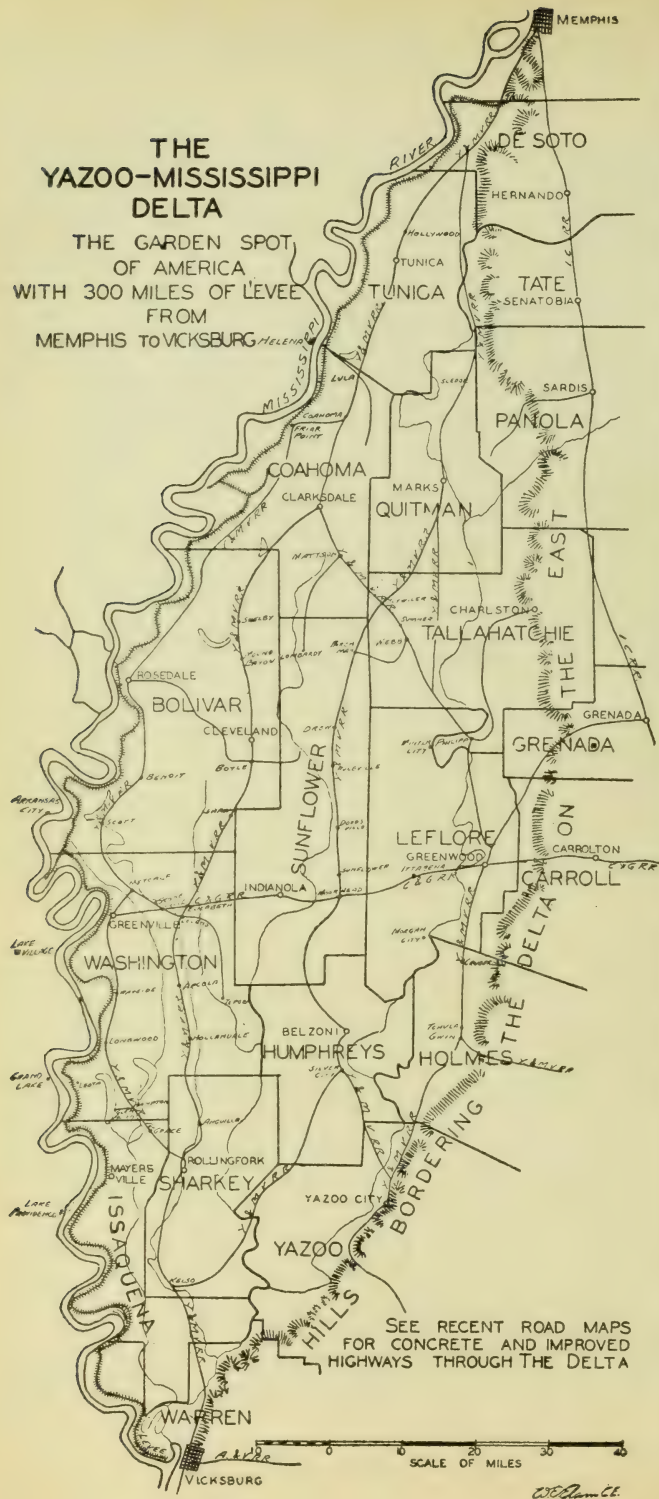


Office and Laboratory building of the Delta Experiment Station.

AN ALLUVIAL EMPIRE

THE YAZOO-MISSISSIPPI DELTA

THE GARDEN SPOT
OF AMERICA
WITH 300 MILES OF LEVEE
FROM
MEMPHIS TO VICKSBURG



REPORT OF THE RAYMOND BRANCH EXPERIMENT STATION

By
H. F. WALLACE

Cotton Fertilizer Analysis Test

Raymond Station 1925-31

600# 4-8-8	\$18.82
600# 4-8-6	\$18.92
600# 4-8-4	\$15.34
600# 4-8-2	\$15.80
600# 4-8-0	\$9.69
600# 8-8-4	\$21.15
600# 6-8-4	\$20.94
600# 4-6-4	\$21.64
600# 4-4-4	\$19.12
1200# 4-8-4	\$31.83
1800# 4-8-4	\$30.95
2400# 4-8-4	\$28.99

Graph showing: Seven year average net gains over no fertilizer treatment by the use of various amounts and analyses of fertilizer.

Mississippi Agricultural Experiment Station
State College, Mississippi,

W. R. PERKINS, Director

INTRODUCTION

This report contains a summary of the work conducted on the Raymond Branch Experiment Station for the year of 1931. Many tables herein will give averages for a period of years, whereby results with various fertilizers and varieties will be more accurate. Other publications from this station may be secured upon request from the Mississippi Experiment Station, State College, Mississippi.

Experiments were conducted to determine the kinds and quantities of fertilizers, varieties and cultural methods for cotton, corn, legume and truck crops best suited for the southern section of the Brown Loam soil area.

All fertilizer formulae used in this report will be given in the order of (N.P.K.) nitrogen, phosphoric acid and potash; that is, we have a 4-8-4 in the place of our well known "8-4-4."

As a crop year, 1931 was fairly good. The early part of the year was favorable to early plowing and large acreages were planted. Some late planted cotton experienced difficulty in germinating, as the season was dry at that time. Legume and small grain crops made bountiful yields. One acre of wheat on the station produced a yield of thirty bushels. Oats produced around fifty bushels, while rye turned out forty bushels. Vegetable crops made good yields, but prices prevented any profits to the growers. Peaches, apples, pears and grapes did exceedingly well and abundant yields were secured. Cotton, corn and soybeans made well and the dry weather practically all the fall made harvesting conditions extremely favorable. Many fields of late cotton were considerably damaged by the weevil. Our eighteen acres in cotton plats produced twenty bales. About 1200 visitors came to the station during 1931.

COTTON

Cotton represents the principal cash crop of our state, hence much attention has been given this crop from a standpoint of varieties, fertilizers, boll weevil control, spacing and disease. A very large majority of our visitors were more interested in cotton than anything else.

Below may be seen the results of twenty-nine leading varieties of cotton which were planted on both valley and hill land, as shown in table 1 for the valley land test, and in table 2 for the hill land test.

Table 1—Variety Cotton Test—Valley Land—1931

Variety Used	Seed Cotton per Acre	Lint Data				Total Value per Acre	Rank
		Lbs. Lint per Acre	Lint Per- centage	Staple Length	Value per Pound		
Miller 589	1977.0	674.2	34.1	1	6.10	47.64	4
Lightning Express 8	1961.1	592.3	30.2	1 1-8	7.35	50.38	1
Rowden 2088	1948.3	619.6	31.8	15-16	5.75	42.27	17
D. & P. L. 4-8	1922.4	684.4	35.6	31-32	5.90	46.57	5
Farm Relief	1891.5	645.0	34.1	1 1-16	6.65	49.13	2
Cleveland 54	1884.3	616.2	32.7	31-32	5.90	42.70	14
Acala 37	1873.9	580.9	31.0	1 1-32	6.40	43.64	9
Cleveland 54	1864.5	607.8	32.6	31-32	5.90	42.14	18
Lone Star 562	1845.6	649.7	35.2	1 1-32	6.40	48.06	3
Stoneville 3	1841.3	642.6	34.9	1	6.10	45.19	7
Wilsontype	1832.6	575.4	31.4	29-32	5.60	38.51	27
Stoneville 2	1825.6	589.7	32.3	1 1-16	6.65	45.39	6
Miller 610	1821.8	604.8	33.2	1	6.10	42.98	11
Stoneville 4	1805.4	594.0	32.9	1 1-32	6.40	44.07	8
Cleveland 54	1804.8	586.6	32.5	31-32	5.90	40.70	24
D. & P. L. 10	1779.9	596.3	33.5	1	6.10	42.29	16
Lone Star 561	1749.0	599.9	34.3	31-32	5.90	41.14	21
Lone Star 168-R	1716.1	574.4	31.9	1 1-32	6.40	40.88	23
Cleveland 884-4	1710.1	559.2	32.7	1 1-16	6.65	42.94	13
Express 17	1700.1	518.5	30.5	1 3-32	6.90	41.68	20
Missdel 2	1689.7	528.9	31.3	1 1-16	6.65	40.98	22
Delfos 6112	1683.7	490.0	29.1	1 1-8	7.35	41.98	19
Stoneville 5	1668.4	607.3	36.4	1	6.10	42.35	15
Cleveland Pied.	1667.4	528.6	31.7	7-8	5.50	34.77	28
Missdel 1	1651.2	506.9	30.7	1 1-8	7.35	42.97	12
Delfos 531	1611.8	501.3	31.1	1 3-32	6.90	40.14	25
Delta-type Webber	1579.9	480.3	30.4	1 5-32	7.85	43.20	10
Delfos 719	1522.5	499.4	32.8	1 3-32	6.90	39.57	26
Half and Half	1319.6	488.3	37.0	13-16	3.50	21.25	29

Table 2—Variety Cotton Test—Hill Land—1931

Variety Used	Seed Cotton per Acre	Lint Data				Total Value per Acre	Rank
		Lbs. Lint per Acre	Lint Per- centage	Staple Length	Value per Pound		
Stoneville No. 4	1405.3	480.6	34.2	31-32	5.90	32.98	2
Wilsontype	1347.8	455.6	33.8	13-16	3.50	20.41	26
Delfos 719	1314.0	467.8	35.6	1 1-32	6.40	34.17	1
Lightning Express 8	1284.8	418.8	32.6	1 1-32	6.40	31.13	4
D. & P. L. 10	1255.0	455.6	36.3	31-32	5.90	30.88	5
Stoneville 2	1249.0	439.6	35.2	31-32	5.90	29.98	6
Cleveland 54	1199.0	411.3	34.3	7-8	5.50	26.56	14
Cleveland Pied.	1183.5	400.0	33.8	13-16	3.50	17.92	28
Farm Relief	1178.5	431.3	36.6	1 1-16	6.65	32.42	3
Cleveland 54	1178.0	414.7	35.2	7-8	5.50	26.63	13
Cleveland 884-4	1155.5	397.5	34.4	1	6.10	28.04	10
Stoneville 3	1153.3	425.6	36.9	15-16	5.75	28.11	9
Lone Star 562	1127.3	422.7	37.5	31-32	5.90	28.46	8
Cleveland 54	1085.8	384.4	35.4	29-32	5.60	25.03	18
Delfos 531	1065.5	368.7	34.6	1 3-32	6.90	28.92	7
Stoneville 5	1057.3	404.9	38.3	15-16	5.75	26.54	15
Missdel 2	1044.0	352.9	33.8	1 1-32	6.40	26.04	16
Halt and Halt	1030.5	409.1	39.7	3-4	3.00	15.38	29
Delfos 6112	1011.8	332.9	32.9	1 1-8	7.35	27.86	11
Missdel 1	1003.8	341.3	34.0	1 3-32	6.90	26.86	12
Rowden 2088	1002.8	346.0	34.5	31-32	5.90	23.70	19
Miller 610	992.3	349.3	35.2	15-16	5.75	23.30	22
Lone Star 561	973.0	355.1	36.5	15-16	5.75	23.51	21
D. & P. L. 4-8	954.8	367.6	38.5	29-32	5.60	23.52	20
Deltatype Webber	938.0	303.9	32.4	1 1-8	7.35	25.51	17
Lone Star 168-R	937.3	325.2	34.7	1	6.10	22.90	23
Acala 37	934.5	313.1	33.5	31-32	5.90	21.58	25
Miller 589	915.5	300.5	36.1	15-16	5.75	21.93	24
Express 17	854.0	275.2	33.0	1	6.10	19.58	27

Recommendations: For hill land, it has been found that Cleveland-54, D & P L-10, the Stoneville's, Lone Star-562, and Miller are leaders. Farm Relief did well this past season, as did Delfos-719, which came first.

For valley land, Delfos-6102 and any of its progenies, Lone Star-562, the Millers, the Stonevilles, Cleveland-54, D & P L strains, Lightning Express and Rowden. To maintain length of staple in the long varieties, always plant them on strong land. Improper gin speeds also injure staple lengths.

The valley land test has been conducted for eleven years, and the hill test for five years. Due to drouth, germination was poor, and it was necessary to plow up and replant the valley test June 2, 1931. There was quite a bit of weevil damage. The hill test was planted April 28. Both tests followed rye and vetch turned under and received 800 pounds of 4-8-4 fertilizer per acre. The valley test was in five series and the hill contained four.

Fertilizers: Most of our visitors to this station are interested in fertilizers for cotton. Depressed finances have changed this interest from commercial to home produced fertilizers to a great extent, and many farmers are combining the two to get excellent results.

In testing kinds of fertilizer it is also imperative to test quantities, so varying amounts up to 2400 pounds per acre have been used on this station. A seven year average net gain with 2400 pounds per acre, after paying for the fertilizer, was \$28.99 greater than the value of the yield of the unfertilized plats. During the same period the 1800 pound application produced a net gain of \$30.95, and the 1200 pounds of 4-8-4 produced a net gain of \$31.83, indicating that a 1200 pound application is about the most profitable limit.

In most of our fertilizer work in this bulletin, the increase was obtained according to the standard adopted by the American Society of Agronomy as reported in volume 16, number 1 of the Journal. The column marked "check yield" was obtained according to the above method by assuming that there is a gradual increase or decrease in fertility of the soil from one plat to another.

Below is to be found the general fertilizer test conducted on the station as listed in table 3:

Table 3—Fertilizer Analysis with Cotton—1931

Lbs. per acre	Analysis	Pounds of Seed Cotton per Acre		Dollars per Acre		Value Not Gain	7-yr. Avg. Net gains over Check
		Actual Yield	Check Yield	Increase Value @ 2c	Cost of Fert.		
	None	888.8	888.8				
600	4-8-8	1437.0	882.6	554.4	11.09	3.64	18.82
600	4-8-6	1549.4	876.4	673.0	13.46	5.96	18.92
600	4-8-4	1467.7	870.2	597.5	11.95	5.09	15.84
	None	864.2	864.2				
600	4-8-2	1471.0	863.8	607.2	12.14	5.74	15.80
600	4-8-0	1379.0	862.4	515.6	10.31	4.46	9.69
600	8-8-4	1609.5	865.0	746.5	14.93	4.53	21.15
	None	862.6	862.6				
600	6-8-4	1612.3	838.8	773.5	15.47	6.79	20.94
600	4-6-4	1570.5	815.0	755.5	15.11	8.76	21.64
600	4-4-4	1414.6	791.2	623.4	12.47	6.72	19.12
	None	767.4	767.4				
3200	4-8-4	1903.5	758.9	1144.6	22.89	8.99	31.83
1800	4-8-4	1953.1	750.4	1202.7	24.05	3.20	30.95
2400	4-8-4	1759.3	741.9	1017.4	20.35	-7.45	28.99
	None	733.6	733.6				

Remarks: This test was planted in three series to Lone Star-65 cotton on April 17, 1931, after having been fertilized on April 11th. A good stand was secured. Records were taken from the three inside rows on each plat of five rows. A study of boll sizes revealed that well balanced fertilizers have a tendency to produce larger bolls.

Recommendations: For general conditions, 600 pounds per acre of a 6-8-4 should give good results. On old cotton lands, where cotton "rusts" or where lespedeza has preceded cotton, it is advisable to use eight per cent of potash instead of four. If the land is heavily infested with coco or Johnson grasses, apply only half of the nitrogen before planting and use the other as a side dressing after chopping. Heavy red clay hillsides may not need potash in some instances, but to insure full returns from the nitrogen and the phosphorus, it is best to apply about four per cent.

Where legumes have been previously grown and turned under, four per cent of nitrogen in a formula should be sufficient. In following heavily fertilized truck crops of the year before with cotton, it may be safe to reduce the phosphorus and potash to one-half that recommended and reduce the nitrogen to four per cent.

Factory Versus Home-Mixed Fertilizers: This is the fourth year this test has been conducted. Stock-run commercial 4-8-4 fertilizers were secured from the Jackson Fertilizer Company and the Meridian Fertilizer Factory and nitrophoska (12-24-12) a highly concentrated fertilizer and plant food, a 4-8-4 with cotton seed hulls as the filler, were used against home-mixed 4-8-4 goods using 16 per cent superphosphate and 34 per cent Rhum's phosphate for the phosphoric acid, Chilean nitrate of soda for nitrogen and muriate of potash for the potash. All fertilizer was applied at the rate of 800 pounds per acre, making the nitrophoska application at the rate of 208 pounds per acre.

This test was fertilized May 2, and planted in five series to Lone Star-65 cotton

Table 4—Factory versus Home-Mixed Fertilizers—1931

Fertilizer Used per Acre	Pounds of Seed Cotton per Acre		Three Year Average 1929-31		Four Year Average Rank
	Actual Yield	Check Yield	Increase 1931	Rank	
800 lbs. of a 4-8-4	1410	1410			
267 lbs. of a 12-24-12	1712	1405	307	4	3
Home-Mixed 4-8-4 Superphos.	1743	1400	343	1	2
Nitrophoska 12-24-12	1582	1395	187	6	5
No Fertilizer	1390	1390			
Meridian 4-8-4	1702	1389	313	2	1
Home-Mixed 4-8-4 Rhum's	1624	1387	237	5	4
Plant Food—Canton	1593	1386	207	8	
No Fertilizer	1385	1385			

NOTE—The fertilizer listed as Plant Food—Canton—was tested three years only.

on May 4, 1931. Each plat consisted of five rows and the records were taken from the three inside rows.

Nitrogen Sources: Many forms of nitrogen are being offered farmers these days, and in turn, they look to the experiment station for advice as to which will give the best results. Due to this fact, quite a bit of attention has been given to finding the best source of nitrogen to use in mixing fertilizers. One test which is listed in table 5 has been conducted for seven years and a new test listed in table 6 has been conducted for three years.

The old test was fertilized April 13 and planted in three series to Lone Star-65 on April 17, 1931. The new test was fertilized May 9, and planted May 11, 1931 and June 3, 1931. Good stands were secured in each instance, except the May 11 planting.

The results for the past year give urea the lead in the old test, and the seven year average shows urea to hold first place, closely followed by calcium nitrate, leunasalpeter and Chilean nitrate of Soda. In the new test, every nitrogen paid dividends but the three year average gives nitrate of soda the lead with calnitro coming second. It was evident that much nitrogen was not used until the fall rains started and then it was too late to really benefit cotton. On other fields where winter legumes and rye are now planted broadcast, one can easily see where fertilizer was applied in the drill last spring.

Table 5—Nitrogen Source Test With Cotton

Source of Nitrogen	Lbs. of seed cotton per acre			7 year average	
	Actual Yield	Check Yield	1931 Increase	Increase	Rank
No Nitrogen	1027	1027	.....	.....	.....
Nitrate of soda	1368	1016	352	252	4
Sulphate of amonia	1351	1004	347	234	5
Leunasalpeter	1357	993	364	267	3
No nitrogen	981	981	.....	.....	.....
Calcium cyanamid	1307	960	347	231	6
Calcium nitrate	1342	938	404	289	2
Urea	1355	917	438	309	1
No nitrogen	896	896	.....	.....	.....

Table 6—New Nitrogen Sources Test With Cotton

Source of Nitrogen	Lbs. of seed cotton per acre			1929-31 Average	
	Actual Yield	Check Yield	1931 Increase	Increase	Rank
Nitrate of soda	919	706	213	350	1
No fertilizer	642	706	-64	-148	13
No Nitrogen	706	706	.....	.....	12
Calcium nitrate	897	706	191	263	7
Nitrate of soda	939	706	233	317	4
Sulphate of ammonia	860	706	154	200	10
Calurca	992	706	286	321	3
Amamphos	773	706	67	46	11
Nitrate of soda	958	706	252	285	6
Arceadian nitrate	994	706	288	223	9
Calnitro	999	706	293	327	2
40% sulphate of ammonia &					
64% nitrate of soda	924	706	218	245	8
Nitrate of soda	980	706	274	289	5

Table 7—Phosphorus Sorces Test

Formula and Source	Pounds of Seed Cotton per Acre			1929-31 Average	
	Actual Yield	Check Yield	1931 Increase	Increase	Rank
6-12-6 Superphosphate	1587	1147	440	242	1
6-0-6 No phosphorus	1147	1147	.....	.....	.....
6-24-6 Rhum's Phosphate	1271	1147	124	70	3
6-12-6 Ammophoska	939	1147	-208	-25	4
6-12-6 Superphosphate	1493	1147	346	221	2

Phosphorus Sources: This is the third year that a test of this nature has been conducted at this station. The fertilizer was applied at the rate of 508 pounds per acre on April 30, and the test was planted to Lone-Star-561 cotton on May 1, 1931.

Plats consist of five rows each 125 feet long, and there were ten series. Superphosphate is far in the lead of Rhum's phosphate or ammonphos. The Rhum's phosphate was applied on a cost basis with superphosphate. Records were kept from the three inside rows.

Potash Sources: Several forms of potash are listed on the market these days and to be able to answer questions regarding these forms or sources, a very extensive potash test has been conducted for the past three years. A three year average puts muriate of potash in the lead, with sulphate of potash second and sulphate of potash-magnesia third. Kainit and manure salt also show up well. Results may be seen in table 8.

When cotton "rusts" badly, it signifies a deficiency of potash in the soil and an application of 100 pounds per acre of muriate or sulphate of potash or 400 pounds of a 12 per cent kainit will very probably correct this condition. In our plats this year, as well as the three years before, those receiving potash in any form hold their foliage much longer than the checks and no potash plants. It is evident in this case that nitrogen and phosphorus do their share in maintaining a vigorous healthy plant, but it remains in the power of the potash to cause the plant to retain its leaves. It is our opinion that a liberal application of a well balanced fertilizer and pure seed will do more to ward off plant diseases than anything else. On all old cotton lands, there is no doubt that it would be advisable to use at least eight per cent potash in a fertilizer formula to be used under cotton.

This test was fertilized April 30, and planted in four series to Lone Star-168 on April 30, 1931, replanted May 18, and again replanted May 28, 1931, on land that is suffering for want of potash.

Table 8—Potash Sources Test with Cotton

Source of potash	800 lbs. per acre of formula used	Pounds of Seed Cotton per Acre			
		Actual Yield	Check Yield	1931 Increase	1929-31 Avg. Increase
Muriate of potash	6-12-6	1444	1233	211	313
No potash	6-12-0	1233	1233	.....	.....
No fertilizer	None	910	1233	-323	-418
Kainit	6-12-6	1413	1233	180	356
Muriate of potash	6-12-6	1647	1233	414	467
Sulphate Pot. Magnesia	6-12-6	1506	1233	273	431
Sulphate of potash	6-12-6	1511	1233	278	458
Manure salt	6-12-6	1514	1233	281	372
Muriate of potash	6-12-6	1584	1233	351	384

Cotton Spacing Work: Our spacing work was ruined in 1930 by a very heavy rain on May 18, but this year it was fertilized on May 2, with 800 pounds of a 4-8-4 per acre, and planted to Lone Star-561 cotton on May 5, 1931, after turning a crop of rye and Austrian winter peas. A good stand was secured and the plats thinned by hand.

A six year average indicates two to three stalks in bunches per foot on three and one-half foot rows on valley land.

For hill land, use three foot rows and leave three to five stalks in bunches per foot. The poorer classes of soil will stand much closer spacing than the fertile soils. Quick maturing, medium sized, small leaved varieties will also stand closer spacing than the slow growing large leaf varieties.

Table 9—Spacing Work with Cotton—Valley Land

No. of stalks		Lbs. of seed cotton per acre 1931	Six-year average 1925-26-27-28-29-31		
per Plot	per Foot		Stalks per foot	Seed cotton per acre	Rank in yield
488	.98	1518	.92	1649	5
968	1.94	1772	1.67	1774	4
1456	2.92	1935	2.31	1819	2
1468	2.95	1968	2.80	1775	3
1384	2.78	1925	3.00	1824	1

Seed Treatment for Seed-Borne Diseases of Cotton: Tests were made again this year in co-operation with the Department of Plant Pathology of the Experiment Station and the State Plant Board, the plan and treatment being furnished

by Dr. L. E. Miles, Pathologist, State College, Mississippi. The sale of these organic mercury disinfectants is being pushed in this territory by commercial organizations and to be able to answer inquiries as to the effectiveness in disease control, this work was continued this year.

Below are the tabulated results in table 10:

Table 10—Seed Treatment Work—Cotton

Seed Treatment	Lbs. seed cotton per acre			1929-30-31 Average	
	Actual Yield	Check Yield	Increase	Increase	Rank
No Treatment	1654	1654	.....	.....	..
Ceresan	1664	1661	3	45	5
Semesan	1710	1668	42	99	2
Semesan, Jr.	1719	1675	44	73	3
K. I. X.	1736	1682	54	107	1
Corono Merco	1704	1689	15	48	4
Delinted—H2SO4	1763	1696	67	45	..
No treatment	1703	1703	.....	.....	..
Calochlor	1608	1698	—90	6	..
Calogreen	1639	1693	—54	69	..
Anshacher-Aigle	1688	1688	.....	10	..
Du-Bay 655	1572	1683	—111	2	..
Du-Bay 681	1505	1678	—173	—80	..
No treatment	1673	1673	.....	.....	..

Remarks: The above test was fertilized with 800 pounds of 4-8-4 per acre on May 2 and planted in three series to Lone Star-561 cotton on May 4, 1931. A quantity of seed was divided into equal parts and each part received a treatment of some nature except the checks. Plats consist of five rows, each 125 feet long. Delinted-H₂SO₄ led in this year's test with 67 pounds of increase in seed cotton per acre.

The treatment K. I. X. gave an increase of 54 pounds of seed cotton for 1931 and leads the three year average with 107 pounds seed cotton increase. Semesan was second in the three year average with 99 pounds increase. Corona Merco has been a leader in past years. This work seems very promising and the table is submitted above for those interested.

Boll Weevil and Plant Lice Control Work: In 1930, weevils were not present in sufficient numbers to get accurate records of this test, hence the table submitted below gives the 1931 results and then an average of the results for 1929 and 1931. There is no doubt that poisoning cotton pays, as our past records will bear out. Each plat represented about three-tenths of an acre and were repeated once only.

The field was fertilized with 800 pounds of a 4-8-4 fertilizer per acre after turning a crop of rye and Austrian winter peas three weeks earlier. The fertilizer was applied May 2 and Lone Star-561 was planted May 5, 1931.

Table 11—Insect Control with Cotton

North to Poison used South	Yield of seed cotton per acre	Increase 1931	1929 and 1931 Average
Calcium arsenate and Nicotine sulphate Mixture—8 to 1	1156	141	248
No poison	1015	.....	.....
Calcium arsenate and Tobacco dust —2 to 1	1149	134	197

Cotton Following Winter Legumes: The purpose of this test is to determine how much nitrogen is stored in the soil by various winter legumes. As the table shows, some of the plats are left bare during the winter and commercial nitrogens are applied. All plats receive an 0-8-4 fertilizer and the commercial nitrogen is added to the check plats.

The legumes were turned about the middle of April, fertilizer applied April 27th and the four series planted to Lone Star-168 on April 28, 1931. Plats consist of five rows, each 125 feet long, and between each plat is one blank row. Below may be seen the results of this test as listed in table 12:

Table 12—Winter Legumes and Cotton Test

Legume Cover Crop	Formula used at 600 lbs. per acre	Yield per acre in lbs. seed cotton	3-year Average 1929-31
No legume	6-8-4	1245	1344
Hairy vetch	0-8-4	1037	1203
Monantha vetch	0-8-4	1112	1212
No legume	0-8-4	783	1017
No legume	6-8-4	1425	1568
Bur clover	0-8-4	1110	1080
Crimson clover	0-8-4	744	915
Austrian peas	0-8-4	863	970
No legume	6-8-4	1269	1302

CORN

The work at this station includes variety tests, fertilizer analysis tests, nitrogen sources test and corn and soybean tests.

Below may be seen table 13, which gives the results of twenty-one leading varieties of corn planted in four series May 8, 1931. Three hundred pounds per acre of a 4-8-4 fertilizer were applied May 5 before planting and when the corn was about twenty inches high, it was hoed and given a side dressing of 200 pounds of nitrate of soda per acre. This test was planted in three foot checks on three and one-half foot rows, each 125 feet in length.

Table 13—Variety Corn Test

Variety	Yield in bushels shelled corn per acre	Per- centage of grain	Rank 1931	Average yield in bushels 1922 to 31	Rank 1922-31	Average yield in bushels 1925-31	Rank 25-31
Mosby, Station	53.56	79.92	10	38.47	7	45.16	7
Mosby, Delta	55.34	81.39	8	41.62	4	48.79	4
Mosby, Suttle	47.23	81.86	15	.....	.....	41.24	10
Cocke's Prolific Sta.	61.49	81.14	2	42.69	2	50.00	3
Cocke's Prolific, Wood	43.67	75.00	18	.....	.....	.....	.....
Cocke's Prolific, Ray	56.97	75.17	6	.....	.....	.....	.....
Hastings	53.48	81.58	11	39.46	6	46.69	5
Jellicorse	54.68	78.56	9	.....	.....	.....	.....
College 47	62.25	80.56	1	.....	.....	.....	.....
Laguna	57.67	77.33	5	43.93	1	50.62	2
Mexican June	53.32	76.08	12	39.80	5	45.10	8
Brouth Resister-Reese	50.29	76.11	14	.....	.....	.....	.....
Paymaster	60.66	77.64	3	42.61	3	52.74	1
Dixie White Dent	58.51	81.14	4	.....	.....	.....	.....
Yellow Dent, Ferg.	39.84	78.61	21	.....	.....	43.44	9
College Y-4	52.36	77.28	13	.....	.....	45.44	6
Golden Dent R-H	44.23	80.86	17	.....	.....	38.59	11
College G-4	56.85	76.36	7	.....	.....	.....	.....
Imp. Golden Dent	40.22	79.72	20	.....	.....	.....	.....
Jarvis	42.75	77.22	19	.....	.....	.....	.....
Standifer Gold. Dent	46.16	78.06	16	.....	.....	.....	.....

Remarks: In this test we used 200 pounds of nitrate of soda per acre this year. In the above table the 1931 results will be found in the first three columns of figures. The fourth column shows the ten year average yield of seven varieties, while the fifth column shows the rank of these varieties for ten years. The average yield of eleven varieties for seven years is given in the next column.

The leading variety for the past three years is College-47 with a 1931 production of 62.3 bushels of shelled corn per acre. This is 22.4 bushels more than the trailing variety produced. Three years ago this same variety led with a production of 81.8 bushels the first time it was tested. Laguna leads the ten year average with 43.9 bushels per acre. Cocke's Prolific was second and Paymaster third in the ten year average with 42.7 and 42.6 bushels per acre respectively.

The Mosby varieties are subject to weevil damage in this section if planted early. Cocke's Prolific, Laguna, Paymaster, College-47 and Hastings are all good varieties to grow. For late plantings, use Mexican June. Extreme care should be taken in the source from which seed corn is purchased. Every farmer should select seed corn in the field and very probably a superior grade of seed could be secured to that offered by some markets.

Table 14—Corn Formula Test

Pounds of Material applied per acre			Bushels ear corn per acre			Three-year
Sodium Nitrate	Super- phosphate	Muriate potash	Actual Yield	Check Yield	Increase 1931	Average Increase
200	-----	-----	29.3	29.3	-----	-----
200	100	-----	29.9	30.3	-0.4	-1.1
200	100	50	31.1	31.3	-0.2	-2.2
200	-----	50	35.1	32.3	2.8	.4
200	-----	-----	33.2	33.2	-----	-----
-----	-----	-----	25.0	33.0	-8.0	-10.0
200	200	-----	35.1	32.7	2.4	1.4
200	200	50	36.7	32.4	4.3	3.1
200	-----	-----	32.1	32.1	-----	-----

Remarks: In this test we used 200 pounds of nitrate of soda per acre as a check, for this element of plant food is certainly essential in the successful production of corn. One plat in each series is left unfertilized and all except the checks vary with the addition of phosphorus and potash.

This test was fertilized May 12 and planted in four series to Cocke's Prolific corn on May 13, 1931. Plats consist of five rows, each 125 feet long. A good stand was secured. It is interesting to note that the unfertilized plats produced 10 bushels less than the plats receiving 200 pounds of nitrate of soda per acre. Two hundred pounds of superphosphate and fifty pounds of muriate of potash added to the 200 pounds of nitrate of soda increased the total yield 3.1 bushels per acre. Fifty pounds of muriate of potash added to the nitrate gave an increase of four-tenths bushels. Superphosphate, when added alone, failed to register an increase.

For general use in fertilizing corn, a mixture of 100 pounds of superphosphate, 50 pounds of nitrate of soda, calcium nitrate or their equivalent in pounds of nitrogen and 50 pounds of muriate of potash per acre will give good results. Any form of potash may be used.

Table 15—Corn Nitrogen Sources

Material used 50 lbs. Nitrogen per acre	Bushels ear corn per acre			Percent Increase	
	Actual Yield	Check Yield	Bushels Increase	1931	6-year Average
No nitrogen	22.81	22.81	-----	-----	-----
Nitrate of soda	24.04	24.02	10.02	29.4	64.0
Sulphate of ammonia	31.36	25.24	6.12	19.5	36.0
Leunasaltpeter	32.99	26.45	6.54	19.8	41.5
No nitrogen	27.67	27.67	-----	-----	-----
Calcium Cyanamid	37.39	26.48	10.91	29.2	42.1
Calcium Nitrate	37.04	25.29	11.75	21.8	61.0
Urea	33.33	24.10	9.23	27.7	54.0
No nitrogen	22.92	22.92	-----	-----	-----

Remarks: Some of the leading sources of nitrogen have been tested under corn on this station for six years. The last column of figures in table 13 represents a six year average with corn, showing the percentage of increase over the check or plats fertilized with 300 pounds of superphosphate and 200 pounds of kainit per acre. All these percentages indicate that nitrogen is very necessary.

The fertilizer used was applied to this test May 12 and Cocke's Prolific corn planted in four series on May 13, 1931. Good stands were secured. Plats consist of five rows, each 125 feet long.

Calcium nitrate leads the 1931 test, closely followed by nitrate of soda, calcium cyanamid and urea. The six year average is headed by nitrate of soda, with calcium nitrate and urea closely following. Nitrogen pays better dividends with corn than any other of the fertilizers in this section.

Table 16—Corn, Soybeans and Peas "At-Lay-by" Test

Method of Planting	Bu. of ear corn per acre			Three Year Average
	Plot Yield	Check Yield	Increase 1931	
Corn, alone	9.54	9.54	-----	-----
Corn with soybeans	19.81	9.45	10.36	10.87
Corn with peas "at-lay-by"	20.14	9.36	10.78	11.71
Corn alone	9.26	9.26	-----	-----

Remarks: Many inquiries come to us as to how much reduction in yield of corn

per acre can be attributed to the growth of soybeans planted in the corn rows or by planting peas in the middles at the "lay-by" cultivation. This test was planted in four series May 13, 1931. In fairness to the soybean, it must be stated that dry weather kept the late planted peas from growing very much. In 1929, there was a reduction of 6.9 bushels of corn per acre where soybeans were planted with corn. The three year average increase was 10.87 bushels for the soybeans and 11.17 for the peas. Besides building up the soil, soybeans make a valuable feed and constitute an additional crop without extra expense as the corn must be harvested any way. By all means, Mississippi farmers should grow soybeans in every row of corn. Harvesting soybeans in corn is best accomplished by turning livestock in the field after the corn is harvested.

Soybean Varieties: Below may be seen the tabulated results of the soybean variety test for comparative yields of hay and grain:

Table 17—Soybean Variety Test for Hay and Grain Yields—1931

Variety	Date of cutting	HAY		RANK		GRAIN		RANK	
		Yield in tons per acre	1931	Average 1928-1931	1931	Date of cutting	Yield in bu. per acre	1931	Average 1928-1931
Geo. Washington	9-4-31	2.17	11	7	9-18-31	12.31	12	4	12.31
Delta 488-607	9-4-31	2.87	6	6	10-1-31	16.05	4	3	16.05
Delta 5406	9-4-31	2.09	12	..	9-18-31	12.86	10	..	12.86
Lexington	9-4-31	1.64	15	..	9-18-31	12.39	11	..	12.39
Elbony	9-4-31	1.77	14	..	9-15-31	13.13	9	..	13.13
U.S.D.A. 36906-R	9-4-31	2.05	13	..	10-2-31	8.78	14	..	8.78
Delta 6114	9-18-31	2.99	4	..	10-12-31	15.54	5	..	15.54
Laredo	9-18-31	2.80	7	3	10-4-31	22.83	1	1	22.83
Mamredo	9-4-31	2.46	9	..	10-2-31	14.57	6	..	14.57
Mammoth Yellow	9-18-31	2.88	5	5	10-6-31	16.13	2	2	16.13
Tar Heel Black	9-18-31	3.61	1	..	10-12-31	16.11	3	..	16.11
Otootan	10-6-31	3.37	2	3	11-3-31	9.93	13	5	9.93
Tanloxi	10-6-31	3.21	3	1	10-23-31	13.46	8	6	13.46
Biloxi-Bush	10-6-31	2.59	8	2	10-23-31	13.62	7	7	13.62
Biloxi-Runners	10-6-31	2.18	10	..	10-23-31	8.23	15	..	8.23

Remarks: The field where this test was conducted was fertilized with 20 pounds of a 4-8-4 per acre and planted May 22, 1931, after turning under a crop of crimson clover three weeks before. Soybeans may be safely planted from March 25 to July 15, but the earlier the planting usually the larger the yields, as the plant has more time to develop. Maturity dates of the varieties remain more or less the same regardless of when planted. For other varieties, we might say that the margin of difference in the dates of maturity are not nearly so great as the margin of difference in the dates of planting.

Soybeans should be cut for hay when the top pods are well formed. This is the good dough stage which makes the hay palatable and of high digestible nutrient content. The leaves will not shed much at this time.

In saving grain, cut when one-half to three-fourths of the leaves have shed, on the other hand, when three-fourth to four-fifths of the pods have lost the green color. Saving beans for seed on the poorer types of soil especially is a good practice as the beans planted will improve the soil. If soybean harvesters are to be used the plants should be permitted to fully mature. On thin land, soybeans should be planted on three foot rows and fertilized with 200 pounds of superphosphate per acre. Where soybeans have never been grown before, the seed should be inoculated to get the best results from a soil improvement standpoint, as well as yields.

A careful study of the harvest dates and yields, in the above table, will be beneficial to those planning to grow this crop. For instance, a schedule of varieties that mature in succession from early to late might be desirable, such as this one: George Washington, Mamredo, Laredo, Tanloxi or Biloxi and Otootan. Again we emphasize the importance of growing soybeans in every row of corn grown in Mississippi.

A late soybean variety test was planted in one-tenth acre plats in two series on July 11, 1931 to ten leading varieties. The Tanloxi led this test with a yield of

9.61 bushels of shelled beans per acre. The Mamredo, a cross of the Laredo and Mammoth Yellow, was a close second with 8.11 bushels per acre, while the Mammoth Yellow and Tar Heel Black were third and fourth respectively with 7.69 and 7.06 bushels shelled beans per acre. Light yields may be expected from late plantings, especially during dry years.

In a phosphorus source test with soybeans, superphosphate increased the yield of grain 69.1 per cent, ammosphoska 66.7 percent and Rhum's phosphate increased the yield 41.4 over no phosphoric acid. Nitrogen and potash were used on all plats.

Forage Crops: Due to the drought this past summer, many calls came to the station in July from farmers who realized they would lose their corn crop and hay crop and be without feed this fall. It was suggested to them to break their tomato and truck lands and plant George Washington soybeans mixed with sagrain in the drill on three foot rows. If no truck lands were available then use 200 pounds 4-8-4 fertilizer per acre before planting the above crop. Reports from fifty or sixty of these farmers were to the effect that these crops make them plenty of feed for the winter.

A test of grain sorghums against Mosby corn for grain yields was put in on poor corn land and planted to three series on May 20, 1931. Sagrain 303 led with a yield of 30.83 bushels of grain per acre, Grohoma was a close second with 30.63 bushels, Mosby corn came third with 24.63 bushels and Texas seeded came fourth with 14.82 bushels grain per acre. Atlas sargo failed to produce seed. This test was fertilized with 200 pounds of 4-8-4 per acre.

A similar test with six sorghums against Mosby corn for silage was planted in five row plats on June 23, 1931. Preceding this, a crop of crimson clover was turned on May 12 and 300 pounds of 4-8-4 fertilizer was applied on May 19. Rain fell May 20 and a month's drought was also broken on June 21. On June 22, the beds were rebroken and rebudded to get the fertilizer back in place and the test planted June 23, 1931. Laredo soybeans were planted in all plats. Good stands were secured.

The Mosby corn plats were ready to harvest on September 11, and came second with 13.45 tons of silage per acre, beans included. Texas seeded cane came first with 17.55 tons and was harvested September 30, 1931. Honey Drip and Atlas sargo tied for third place with 9.75 tons, Hegari with 9.50, Sagrain-303 with 7.80 and Grohoma last with 5.40 tons of silage per acre. The period of harvesting ranged from September 11 to the 30th.

Alfalfa: Lime is necessary for the growth of alfalfa. On our non-lime lands, four tons of crushed limestone per acre must be applied every three or four years to grow this crop. There are two fields of alfalfa that were planted last October now growing luxuriantly on the station. One field was limed six years ago and the other three years ago. Fertilizer work with this crop favors phosphorus and nitrogen. The first cuttings here are always good, but unless a weeder is run over the patch just after mowing, the second cutting will be about half crab grass. A couple of acres in this crop near the barn furnishes nice winter grazing for poultry and young stock, and the hay comes in well on the ration for other stock, but as a commercial proposition, alfalfa will never be successfully grown on our non-lime lands. Alfalfa should always be planted on well drained soils catering to the clays more or less. Due to an unusually mild winter, our alfalfa was ready to cut Christmas day. A rotary hoe is the best competitor of crab grass that we have found for alfalfa fields. After each cutting, the rotary hoe is used.

Oats, Rye and Wheat: These small grains made splendid yields this year. All were planted in 1930. Rust Proof and the Norton's are the most popular oats in this section and the Appler will also make good yields. Winter killing is less frequent in the Norton. Yields of forty-five bushels per acre were secured. Rye does not winter kill and makes good winter grazing. Abruzzi rye gives best results, but is bearded and must be turned with a companion legume crop after grazing. Blue Stem wheat produced thirty bushels per acre this year on the station. Red May also does well.

HORTICULTURE

The horticultural investigations include the testing of varieties and fertilizer requirements of tomatoes, English peas, and snap beans. These crops are grown extensively in the Crystal Springs-Utica-Hazlehurst trucking area, which is in close proximity to the Raymond station.

Tomatoes: As in past years, the leading strains and varieties grown in the trucking area were tested in 1931. The seeds were planted in the hot-bed January 20; transplanted to the coldframes March 1; and set in the permanent beds two feet apart in rows three and one-half feet apart. Ideal transplanting weather prevailed and good stands were secured. The plants were pruned to the single stem system and staked. Just before the plants were set in the field a commercial fertilizer analyzing 4-8-4 was applied at the rate of 1500 pounds per acre. Fruits were harvested in the green mature state of maturity.

Table 18—Tomato Variety Test—1931

Variety	Yield in lbs. per acre		Per Cent	Percent picked early		Average size of Shippers in lbs.	5-year Average Percent
	Total	Ship- pers		Total	Ship- pers		
Livingston Globe—R	7985	6148	74	36	33	.256	67.2
Livingston Globe—C	8950	6451	72	34	33	.248	.....
Gulf States—R	9840	7382	75	50	52	.260	68.8
Detroit—F	8851	6223	70	48	50	.253	65.6
Marglobe (Reuter)—R	14559	11139	76	52	54	.293	68.6
Marglobe Pritchard—P	12758	10080	79	37	41	.273	.....
Norton—R	13509	9122	67	39	40	.310	65.8
Coopers-Special—R	7698	4557	59	39	48	.231	61.0
Royal Purple—R	8901	7315	82	38	42	.260	.....
Marvana	10228	6421	63	56	53	.239	.....
Marvelosa—P	14254	9999	70	38	41	.270	.....
Louisiana Pink—R	10505	7453	71	34	41	.255	65.1
Louisiana Red—R	12736	7825	61	31	36	.260	61.9
Taylor—T	16297	12238	75	52	60	.301	.....
Poster—F	11053	7999	72	45	50	.271	65.5
Kilgore Special—K	8816	6207	70	19	19	.209	.....

*Local varieties.

The figures presented in Table 18 show that Taylor (a local variety) produced the highest yields of shippers followed by Marglobe (Reuter), Marglobe (Pritchard), Marvelosa, and Norton in the order named. Norton, Taylor, Marglobe (Reuter), and Marglobe (Pritchard) produced the largest sized marketable fruit, while Royal Purple (Rise) and Marglobe (Pritchard) produced the highest percentage of marketable fruit. The figures show that Gulf States, Marglobe (Reuter), and Livingston Globe produced the highest percentage of shippers.

Growers should continue to raise the standard varieties, such as, Marglobe, Gulf States, and Livingston Globe until superceded by superior sorts.

Table 19—Effect of Various Fertilizers on Yield of Tomatoes—1926-31

Analysis	Yield in lbs.		Per cent Ship-pers	Percent Picked		Dollars per acre		
	per acre			early		Value	Cost	Value
	Total	Ship-pers		Total	Ship-pers	6c per lb.	of Fertilizer	less Fertilizer Cost
1500 Pounds per Acre								
3-10-3**	13247	8392	62.5	46.0	47.1	\$503.52	\$19.74	\$483.78
3-10-3*	14409	10135	69.7	44.4	45.3	608.10	25.50	582.60
3-8-3	13933	9255	65.9	47.3	46.2	561.30	18.05	543.25
4-8-4	14096	9231	65.3	47.4	45.8	553.86	21.38	532.48
5-8-3	14134	10106	71.1	44.8	46.0	606.26	33.96	582.40
2000 Pounds per Acre								
3-10-3**	15290	10767	68.9	50.8	47.7	646.02	26.32	619.70
3-10-3*	14344	9446	65.3	44.6	44.6	566.76	34.00	532.76
3-8-3	14045	9412	66.6	46.9	47.3	564.72	27.04	537.68
4-8-4	12740	8648	66.8	47.2	45.7	521.04	28.51	492.53
5-8-3	14452	10282	69.7	44.9	46.4	616.92	31.95	584.97

*Commercial mixture used extensively in Crystal Springs trucking area.

**Home mixture.

Test's With Complete Fertilizers: In this test plants of the Marglobe variety were set two feet apart in rows three and one-half feet apart; staked and trained to the single stem system; and topped at the fourth cluster. Fruits were harvested in the green mature stage of maturity.

The figures presented in Table 19 show that 4-8-4 and 3-8-3 produced the greatest value less fertilizer cost per acre applied at the rate of 1500 pounds per acre; while the 3-10-3 mixture produced the largest yield of marketable fruits and greatest value applied at the rate of 2000 pounds per acre. For both applications the results for the 5-8-3 mixture were similar.

Though these results indicate that fertilizers analyzing 3-10-3 and 5-8-3 are superior to the other combinations tested, growers should continue to use the standard 4-8-4 mixture or fertilizers with a 1-2-1 ratio until other mixtures are found to be superior to it for the growing of tomatoes in the Crystal Springs trucking area.

Table 20—Effect of Various Quantities of Potash on Yields of Tomatoes—1924-31

Treatment	Yield in lbs. per acre		Per cent Ship- pers	Percent Picked early		Dollars per acre		
	Total	Ship- pers		Total	Ship- pers	Value	Cost	Value
						6c per lb.	of Ferti- lizer	less Fertilizer Cost
1000 Pounds per Acre								
4-8-0	13666	8356	60.1	47.7	54.2	\$501.36	\$10.44	\$490.92
4-8-4	14133	8668	57.4	49.1	49.1	520.08	12.52	507.56
4-8-8	14533	8202	54.9	47.1	49.6	492.12	13.56	478.56
1500 Pounds per Acre								
4-8-0	14515	8620	56.7	45.5	51.6	517.20	15.66	501.54
4-8-4	13414	8131	58.2	49.7	49.1	487.86	18.78	469.08
4-8-8	13736	8610	61.0	45.1	46.8	516.60	20.34	496.26
2000 Pounds per Acre								
4-8-0	14246	8557	56.9	44.7	43.9	513.42	20.88	492.54
4-8-4	14323	8807	57.7	47.8	50.7	528.42	25.04	503.38
4-8-8	12974	7704	58.5	40.4	40.8	462.24	27.12	435.12

Tests With Potash: Plants of the Marglobe variety were used and handled in the same manner described on page 12. The potash was derived from muriate of potash; the phosphoric acid from super-phosphate, and the nitrogen from equal quantities of nitrate of soda, sulphate of ammonia, and cotton seed meal.

The figures (Table 20) show that though the effects of potash are inconsistent for the different rates of application, in two cases out of three the 4-8-4 mixture produced the greater value per acre; while the 4-8-8 mixture produced the lesser value. In this experiment the muriate of potash showed no tendency to delay earliness of maturity.

Until additional information is available, growers should use fertilizer mixtures analyzing at least 4% potash for the production of satisfactory crops.

Table 21—Nitrogen Sources Test with Tomatoes—1924-1931

Nitrogen Sources	Yield in lbs. per acre		Per Cent	Percent picked early		Total Market Value 6c lb.	Rank
	Total	Ship- pers		Total	Ship- pers		
1500 Pounds 4-8-4 per Acre							
Nitrate of Soda	11776	6846	58.3	45.6	49.5	\$410.76	3
Ammonium Sulphate	10993	6385	58.2	51.5	51.1	383.10	4
Combination*	11337	6918	61.0	48.3	49.3	415.08	2
Cottonseed Meal	12249	7392	60.4	46.4	46.3	444.52	1
Calurea**	10330	6173	59.3	48.4	51.2	370.38	5
2000 Pounds 4-8-4 per Acre							
Nitrate of Soda	11566	6693	57.9	45.4	47.7	401.58	3
Ammonium Sulphate	11240	5898	59.1	51.0	52.1	353.88	5
Combination*	12002	6836	57.1	45.6	46.2	419.16	2
Cottonseed Meal	12104	7180	59.4	42.6	44.0	430.80	1
Calurea**	11054	6526	59.3	52.0	56.4	391.56	4

*Nitrate of soda, ammonium sulphate and cotton seed meal in equal quantities.

**Calurea was substituted for Urea in 1930.

Tests With Nitrogen: The nitrogen sources tests were continued in 1931. Plants of the Marglobe variety were set in duplicate plots April 17.

The figures presented in Table 21 show that for both rates of application cotton seed meal produced the greatest yields, the greatest percentage of shippers, and the lowest percentage of fruits shipped early, followed by the combinations mixture and nitrate of soda in the order named. With the exception of the treatments consisting of nitrate of soda the value less fertilizer cost per acre was greater for the 1500 pound application than for the 2000 pound application. The data indicate that the use of cotton seed meal may be advantageous, particularly when the cost of this material is relatively low and that applications of 1500 pounds per acre of a complete mixture are sufficient for the production of satisfactory crops.

Additional nitrogen sources tests were started in 1929. Table 22 presents the averages obtained for the past three years. The Marglobe variety was used.

The results (Table 22) show that for the 1500 pound application cotton seed meal produced the greatest total yields, the greatest percentage of shippers, and the greatest value less the cost of the fertilizer, followed by calcium nitrate, a mixture consisting of one-half sulphate of ammonia and one-half cotton seed meal,

Table 22—Nitrogen Sources Test with Tomatoes—1929-1931

Nitrogen Sources	Yield in lbs. per acre		Per cent	Percent picked early		Dollars per acre			Size of Fruit Pound
	Total	Ship- pers		Ship- pers	Total	Ship- pers	Value 6c per lb.	Cost of Ferti- lizer		Value less Ferti- lizer cost
1500 Pounds of 4-8-4 per Acre									
Nitrate of Soda	14293	10065	71.4	45.8	44.1	603.90	20.64	583.26	0.250
Ammonium Sulphate	14020	10117	71.5	49.9	47.1	607.02	19.08	587.94	0.283
Cottonseed Meal	15949	11859	73.5	46.6	46.5	711.54	31.44	680.10	0.278
Combination*	13747	9887	73.0	48.3	48.9	593.22	23.60	569.62	0.280
Half Soda and Half Meal	13635	9597	70.9	41.2	40.1	575.82	25.86	549.96	0.273
Half Sulphate and Half Meal	13752	9657	71.2	48.1	48.4	579.42	25.26	554.16	0.271
Calcium Nitrate	14691	10582	71.4	46.5	45.9	634.92	20.64	614.28	0.284
Calurea	13678	9936	73.1	46.7	45.2	596.16	16.68	579.48	0.289
2000 Pounds of 4-8-4 per Acre									
Nitrate of Soda	13553	9116	66.8	40.2	39.3	546.96	27.52	519.44	0.277
Ammonium Sulphate	13008	9060	69.7	47.5	45.7	543.60	25.44	518.16	0.286
Cottonseed Meal	14431	10227	69.9	34.5	32.5	613.62	41.92	571.70	0.281
Combination*	13521	9339	68.6	40.7	35.9	560.34	31.87	528.47	0.284
Half Soda and Half Meal	13156	9419	71.3	42.2	43.1	565.14	34.48	530.66	0.270
Half Sulphate and Half Meal	15015	10816	71.9	46.1	48.0	648.96	33.68	615.28	0.274
Calcium Nitrate	14407	10815	75.7	44.1	45.1	648.90	27.52	621.38	0.276
Calurea	18045	9243	71.1	51.7	54.6	554.70	22.24	532.46	0.275

*Nitrate of Soda, Sulphate of Ammonia and Cottonseed Meal in equal amounts.

Table 23—Average Results of Analysis Test with English Peas—(Eight year average, 1924-1931)

Dollars per acre						
Analysis	Yield lbs. per acre	Value 5c lb.	Cost of ferti- lizer	Value less fertilizer cost	8-year average rank	1931 Yield per acre
1000 pounds per acre						
3-10-3	3314	\$165.70	\$11.59	\$154.11	1	3348
4-8-4	3039	151.95	12.52	139.43	3	3213
6-8-4	2208	110.40	16.80	93.60	--	3297
4-8-0	2358	117.99	10.44	107.46	--	2965
1500 pounds per acre						
3-10-3	3217	160.85	17.39	143.46	2	3328
4-8-4	3105	155.25	18.78	136.47	4	3100
6-8-4	2413	120.65	25.20	95.45	--	3487
4-8-0	2407	120.35	15.66	104.69	--	3060

Note: The analysis 6-8-4 and 4-8-0 were tested 1929-1931 only.

and nitrate of soda in the order named. For the 2000 pound application, calcium, nitrate produced the greatest value followed by the one-half ammonium sulphate and one-half cotton seed meal mixture, and cotton seed meal.

Since these results are somewhat inconsistent, further tests are necessary before definite recommendations can be made.

This test was conducted to determine the most economical fertilizer to use in the commercial production of garden peas. The Thomas Laxton variety was used. In all mixtures Combination nitrogen was used.

Table 23 presents results for a period of eight years with the exception of the 3-8-4 and the 4-8-0 analysis. The 3-10-3 produced larger returns per acre in both the 1000 and 1500 pound applications, with the 1000 application in the lead with value less fertilizer cost of \$154.11 per acre. A 3-10-3 fertilizer applied at the rate of 1000 pounds per acre is recommended for the production of this crop.

Table 24—Average Results of Nitrogen Sources Test with English Peas (Eight year Average—1924-31)

	Yield in lbs. per Acre	Eight Year Average Rank	1931 Rank	1931 Yield per Acre
1000 Pounds per Acre of a 4-8-4				
Nitrate of Soda	3584	2	5	3195
Ammonium Sulphate	3597	1	8	2941
Combination**	3044	6	2	3324
Planted*	2188		7	3017
1500 Pounds per Acre of a 4-8-4				
Nitrate of Soda	3484	5	4	3291
Ammonium Sulphate	3466	4	6	3186
Combination**	3324	5	1	3988
Planted*	2341		2	3381

*Leuna Saltpeter was tested 1924-30, Calumet 1931.

**Nitrate of Soda, Sulphate of Ammonia, and Cottonseed Meal in equal amounts.

This test was conducted to determine the most economical source of nitrogen for producing the commercial pea crop. The Thomas Laxton variety was used. The sources used are stated in Table 24. The 4-8-4 formula was used exclusively.

Ammonium sulphate in the 1000 pound application led the eight year average with 3597 pounds of peas per acre. Chilean nitrate of soda comes second with 3584 pounds of peas per acre. Combination led the 1931 test producing in the 1500 pound application 3988 pounds of peas per acre. Either of these three nitrogens named could easily be recommended, but ammonium sulphate has a slight advantage.

English Peas Variety Test: The variety test with English peas gave the following results: Alaska, 3944; Thomas Laxton, 3855; Gradus, 2293; and Record, 2177 pounds of green peas per acre. The Thomas Laxton led in 1930 with a yield of 4694 pounds of green peas per acre. The Thomas Laxton is usually preferred because of its productivity and ability to produce large, well filled pods.

Table 25—Average Results of Analysis Test with Snap Beans—(Eight Year Average—1924-1931)

Analysis	Yield lbs. per acre	Dollars per acre			5-year average rank	1931 Yield per acre
		Value for lb.	Cost of ferti- lizer	Value less fertilizer cost		
—1000 pound application per acre—						
10-3	3255	\$162.75	\$11.59	\$151.16	8	597
8-4	3288	144.40	12.52	131.88	7	468
8-8-4	4194	209.70	16.80	192.90	3	477
8-8-0	3981	199.05	10.44	188.61	4	400
—1500 pound application per acre—						
10-3	3724	186.20	17.39	168.81	5	965
8-4	3747	187.85	18.78	169.07	6	851
8-4	5402	270.10	25.20	244.90	1	583
8-8-0	4816	240.80	15.66	225.14	2	440

Note—The analyses 6-8-4 and 4-8-0 were tested 1929-1931 only.

This test was conducted to determine the most economical fertilizer analysis for the commercial production of snap beans. Giant Stringless green pod was used. The 6-8-4 and the 4-8-0 analyses were tested only during 1929 and in 1931.

Table 25 shows that the eight year average favors the 6-8-4 mixture in both the 1000 and the 1500 pound applications with respective values less fertilizer cost of \$192.90 and \$244.90. The 1931 results favor the 3-10-3 in both the 1000 and the 1500 pound applications. The 1000 pound 4-8-4 application led in 1930 with a production of 4093 pounds of beans per acre, and the 1000 pound 6-8-4 was second with 3632 pounds. The 1500 pound application of 6-8-4 apparently is the most desirable of the fertilizers tried. It is evident that ample quantities of nitrogen are required by the bean.

Table 26—Average Results of Nitrogen Sources Test with Snap Beans—(Eight Year Average—1924-31)

Nitrogen Sources	Yield in lbs. per acre	Eight year average Rank	1931 Rank	Yield per Acre 1931
1000 Pounds per Acre of a 4-8-4				
Nitrate of Soda	3479	4	5	657
Ammonium Sulphate	3524	3	4	734
Combination*	3266	7	8	495
Calurea	4217	1	3	746
1500 Pounds per Acre of a 4-8-4				
Nitrate of Soda	3433	5	2	829
Ammonium Sulphate	3210	8	1	959
Combination*	3291	6	7	564
Calurea**	4047	2	6	629

*Nitrate of soda, sulphate of ammonia, and cotton seed meal in equal amounts.

**Calurea was substituted for Urea since 1929.

The object of this test was to determine the most economical source of nitrogen in the commercial production of snap beans. The sources were tested in a 1000 and 1500 pound application of 4-8-4 per acre. Calurea was substituted for urea during the last three years. The Giant Stringless variety was used.

The eight year average, as well as the 1931 results of the 1000 pound application per acre, gives calurea the lead with a production of 4217 pounds of beans per acre. Ammonium sulphate was second with 3524 pounds of beans per acre. Calurea also led the 1500 pound application with a yield of 4047 pounds of beans per acre. It would appear that 100 pounds of fertilizer per acre using calurea or ammonium sulphate could be recommended.

Snap Bean Variety Test: This test was planted April 11, 1931, with the following results: Sure Crop Stringless Wax, 2062; Valentine, 1990; Prolific Black Wax, 1326 and Giant Stringless, 1051 pounds of green beans per acre. The crop was very late and the season very dry. The Giant Stringless, Yellow Wax and Valentine are the three leading varieties grown in this section.

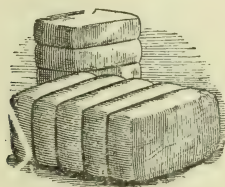
Grade, Staple and Variety of Mississippi Cotton

CROPS OF 1928-1932

BY

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Department of Agricultural Economics



United States Department of Agriculture,
Bureau of Agricultural Economics,
Division of Cotton Marketing

in cooperation with

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION,
STATE COLLEGE, MISSISSIPPI

J. R. Ricks, Director

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INTRODUCTION

Among the numerous crops produced on the farms of Mississippi, cotton easily occupies first place from the standpoint of contribution to the gross income from crop production. Ordinarily, about 75 per cent of gross income from crops in the state is derived from cotton. It is evident, therefore, that not only the welfare of the farmers of the state depends largely on the returns from the cotton crop, but since the entire state is largely dependent on its farming resources, the economic life of the state ebbs and flows with the fortunes of the cotton producers.

Cotton is produced in measurable quantities in 79 of the 82 counties of the state, with the greatest concentration of production in what is locally known as the "Delta." For the purposes of this report, the state has been divided into two areas designated respectively as the Yazoo-Mississippi Delta and the Hill Sections (Figure I). The dividing line does not follow precisely the soil divisions suggested by the designations, but is adapted to county lines with consideration given to the type of cotton produced and the particular conditions under which cotton is grown. Thus, Holmes, Yazoo and Warren counties are included in the Yazoo-Mississippi Delta because over 50 per cent of the cotton ginned in these counties is grown under typical "Delta" conditions.

The Yazoo-Mississippi Delta is characterized by a level terrain, fertile soil of considerable uniformity, large holdings, and the plantation system of management. The Hill Sections are rolling to hilly with soils varying greatly in fertility and physical structure, while the family operated farm may be considered as the prevailing type.

SCOPE AND METHOD

This report contains statistical data covering, in most instances, five years' results of a cotton grade and staple study together with a survey of the varieties of cotton grown in the state, both made on a county basis. The period covered is for the crop years 1928 to 1932, inclusive. The principal factors influencing the findings are enumerated and suggestions for further improvement in the quality of cotton are made. The purpose is to give to agricultural workers and farmers information which will aid them in formulating the best possible cotton production program.

The data contained in this report pertaining to grade and staple of cotton were obtained by entering into cooperative agreements with gin operators whereby these operators supplied a sample from each bale ginned at their respective plants during the season. These samples were classed by specialists in cotton classing regularly employed by the Division of Cotton Marketing, Bureau of Agricultural Economics, United States Department of Agriculture. In this manner, samples were obtained and classed from an average of about 9.0 per cent annually of the bales ginned in the Yazoo-Mississippi Delta, and an average of about 8 per cent annually of the bales ginned in the Hill Sections for the 5-year period 1928-1932. The distribution of the several grades and staple lengths are regularly released for the state as a whole by the Bureau of Agricultural Economics, United States Department of Agriculture. This data contained in this report are based on the classification of cotton from individual gins in order to associate the cotton with the county wherein it was ginned. In calculating the percentages representing the proportionate distribution of the different grades and staple lengths, the data were not weighed by ginning periods.

The data pertaining to varieties of cotton grown in the several counties were obtained by having 90 to 100 per cent of the ginner in each county estimate the percentages of each of the several varieties produced in their gin territories. For comparing varietal staple lengths as determined by classers, the staple lengths of the several varieties as reported by the Experiment Station ^{1/} were used.

^{1/} Mississippi Agricultural Experiment Station: Bulletins 262, 264, 266, 271, 274, 285, 286, 287, 288, 296, and 297; Circulars 82, 87, and 88; and Service Sheets 19, 27, 59 and 86.

TABLE 1.

Staple length of American Upland cotton ginned in Mississippi and in the United States, crop years 1928, 1929, 1930, 1931, and 1932 ^{1/}

Staple Length In Inches	CROP YEAR					
	5-year average		1928		1929	
	Miss.	U. S.	Miss.	U. S.	Miss.	U. S.
	1,000 Bales	1,000 Bales	1,000 Bales	1,000 Bales	1,000 Bales	1,000 Bales
TOTAL CROP	1,531.4	14,353	1,459.2	14,241	1,875.2	14,515
Shorter than 7/8	137.3	1,728.0	283.8	2,047	189.7	2,920
7/8 and 29/32	277.9	5,633.0	299.7	5,947	352.3	5,534
15/16 and 31/32	206.6	3,521.0	132.1	3,244	226.8	2,748
1 and 1-1/32	190.9	1,883	133.9	1,605	202.5	1,693
1-1/16 and 1-3/32	297.9	924	223.7	766	388.6	937
1-1/8 and 1-5/32	313.1	519	255.0	446	412.3	556
1-3/16 and longer	107.7	145	131.0	186	103.0	127
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
TOTAL ..	100.0	100.0	100.0	100.0	100.0	100.0
Shorter than 7/8	9.0	12.0	19.5	14.4	10.1	20.1
7/8 and 29/32	18.1	39.3	20.5	41.7	18.8	38.1
15/16 and 31/32	13.5	24.6	9.1	22.8	12.1	18.9
1 and 1-1/32	12.5	13.1	9.2	11.3	10.8	11.7
1-1/16 and 1-3/32	19.5	6.4	15.3	5.4	20.7	6.5
1-1/8 and 1-5/32	20.4	3.6	17.5	3.1	22.0	3.8
1-3/16 and longer	7.0	1.0	8.9	1.3	5.5	.9

TABLE 1.

Staple length of American Upland cotton ginned in Mississippi and in the United States, crop years 1928, 1929, 1930, 1931, and 1932 ^{1/}

Staple Length In Inches	CROP YEAR					
	1930		1931		1932	
	Miss.	U. S.	Miss.	U. S.	Miss.	U. S.
	1,000 Bales	1,000 Bales	1,000 Bales	1,000 Bales	1,000 Bales	1,000 Bales
TOTAL CROP	1,458.4	13,730	1,703.5	16,582	1,160.7	12,695
Shorter than 7/8	114.8	1,834	65.3	1,014	32.8	826
7/8 and 29/32	304.5	5,321	284.8	6,581	148.1	4,781
15/16 and 31/32	274.8	3,421	237.5	4,515	161.8	3,676
1 and 1-1/32	216.8	1,742	230.8	2,551	170.3	1,823
1-1/16 and 1-3/32	304.6	967	302.1	1,077	270.9	874
1-1/8 and 1-5/32	204.3	383	364.9	587	328.9	624
1-3/16 and longer	38.6	61	218.1	257	47.9	91
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
TOTAL ..	100.0	100.0	100.0	100.0	100.0	100.0
Shorter than 7/8	7.9	13.4	3.8	6.1	2.8	6.5
7/8 and 29/32	20.9	38.8	16.7	39.7	12.8	37.7
15/16 and 31/32	18.8	24.9	14.0	27.2	13.9	28.9
1 and 1-1/32	14.9	12.7	13.6	15.4	14.7	14.4
1-1/16 and 1-3/32	20.9	7.0	17.7	6.5	23.3	6.9
1-1/8 and 1-5/32	14.0	2.8	21.4	3.5	28.4	4.9
1-3/16 and longer	2.6	.4	12.8	1.6	4.1	.7

1/ Preliminary reports of the U. S. Department of Agriculture, released in April of the years 1928-1933.

GRADE

"Grade," as used in denoting a quality of cotton, "is a term denoting the composite of: (a) color, luster, and brightness of the lint; (b) nature and quantity of foreign matter present in the lint, such as leaf, dust or other foreign matter; and (c) the preparation or ginning." ^{1/}

Some of the principal factors affecting grade are the weather and the moisture content of the seed cotton as presented for ginning, the variety of cotton, insect damage, method of harvesting and the ginning process. Since weather plays such an important part in determining grades and since the producer has no control over weather conditions, it was not considered worth while to present a complete distribution of grades of cotton produced in Mississippi in this report. Only the percentage of cotton grading White Middling and better is shown (Tables 2 and 3).

Although the producer has no control over the weather, he may still exercise his abilities to mitigate its influence by taking every advantage of fair weather to pick cotton early in the season and by properly drying all damp or green cotton before ginning.

Off colors of cotton lint are usually due to exposure to weather although they may result from excessive insect damage which, in turn, may often be attributed to unfavorable climatic conditions. The problem confronting the producer as regards color is whether, in view of present and prospective prices, it would be more profitable to ex-

1/ U. S. Department of Agriculture Department Circular 278, By Arthur W. Palmer.

pend more for picking labor early in the season or risk taking a reduced price because of discoloration. It should be remembered, however, that the factors of leaf, sand and dust accumulation present themselves simultaneously with discoloration when cotton is exposed to the weather.

The nature and quantity of foreign matter in cotton lint depends, not only on the severity of the weather and the duration of exposure, but also on the storm resistance of the variety grown, the nature of the soil and the care with which the cotton is picked. Here, in addition to considering the advisability of increased expense for early picking, the producer should determine the degree to which easy picking qualities are to be sacrificed for storm resistance and whether or not quality of picking should be sacrificed for speed of picking. The trends in cotton prices and the plan of marketing should be considered in deciding whether to employ sufficient pickers to carefully pick all cotton early; use fewer pickers and less care, but still finish early; or use few pickers picking carefully and risk weather damage in the field.

Damage during the ginning process results, in most cases, from high moisture content of the seed cotton. Such moisture may be due either to greenness or exposure to dew or rain. The producer offering wet cotton for ginning is wholly responsible for gin damage resulting from such conditions. The solution is obvious. Seed cotton should be dry when presented at the gin. Damage resulting from defects in ginning machinery and from faulty gin operation are engineering problems and, as such, are not within the sphere of this report.

STAPLE LENGTH

Staple length of cotton means the normal length of a typical portion of its fibers.

The primary factor contributing to staple length is the variety of cotton produced, although soil fertility, climatic conditions and the ginning process each exerts some influence on the ultimate length of staple.

Tables 2 and 3 show statistically, while Figures II and III show graphically, the proportions of the several staple lengths of cotton produced in the Yazoo-Mississippi Delta and the Hill Sections of the state for the 5-year period 1928-1932. In most cases the tabular data are shown on the basis of individual counties. Only in areas of relatively light production are two or more counties combined.

The Yazoo-Mississippi Delta has long been an established area for the production of staple cotton, the bulk of the crop stapling 1-1/16 inches and longer. During the five years covered by this study, some fluctuations have occurred in the proportions of the different staple lengths due to current or prospective staple premiums, but on the whole this area may be considered as about stationary insofar as trends in staple length of cotton produced is concerned. It is at the point where marked increases in the proportions of extremely long

staples may prove as unprofitable as such increases would be in the shorter staple group because of the longer growing season required by the extremely long staple varieties and the additional hazards involved.

When we turn our attention to the Hill Sections (Table 3, and Fig. III), the data present an entirely different aspect. The improvement in staple length during the five years of this study has been phenomenal. The proportion stapling less than 7/8 inches decreased from 35.7 per cent for the crop of 1928 to 5.6 per cent for the crop of 1932. During the same time, the proportion of 7/8-inch cotton decreased from 37.8 per cent to 25.3 per cent. While these decreases were occurring the proportion of 15/16-inch cotton increased from 13.1 per cent to 28.0 per cent and the proportion of 1-inch cotton increased from 7.6 per cent to 25.0 per cent. Lesser increase occurred in the proportions of longer staple lengths.

Figure IV shows in a different way how shifts in the predominating lengths of staples have occurred in the two areas of the state during the 5-year period and the influence of the combined movements on the modal length of the entire cotton crop for the state. In 1928, the state produced high percentages of long staples supplying a select market and a high percentage of very short staples which were untenderable on contracts under Sec. 5 of the U. S. Cotton Futures Act. Only about 18.0 per cent consisted of those medium length staples, 15/16 and 1 inch, which are preferred by domestic spinners. In 1932, the state still supplied the select markets with long staples, cotton untenderable on contract because of length of staple was of almost negligible quantity and the proportion of 15/16 and 1-inch staples in the state's crop was 43.3 per cent.

TABLE 2.

Production $1\frac{1}{2}$; grade (Middling White and better); and staple length of cotton ginned in the Yazoo-Mississippi Delta, crop years 1928, 1929, 1930, 1931 and 1932, with averages $2\frac{1}{8}$

		Grade		Staple length (inches)				
		White Mid. 1-3/16 & 1-1/8 & 1-1/16 & 1 & 15/16 Shorter Year Production & better longer 1-5/32 1-3/32 1-1/32 & 31/32 than 7/8						
	Bales	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Totals	1928—752,564		19.8	39.7	29.1	8.2	2.0	1.2
for	1929—970,819	72.1	11.6	44.1	35.4	7.6	1.0	.3
	1930—606,137	72.0	7.0	35.2	41.7	12.3	3.3	.5
	1931—889,186	75.7	23.3	38.8	27.1	8.8	1.5	.5
Delta	1932—567,327	71.6	7.9	53.0	34.4	4.2	.4	.1
	Ave.—757,207	73.1	14.8	41.9	33.0	8.2	1.6	.5
County	1928—128,043		15.8	46.9	30.8	5.3	.9	.3
Bolivar	1929—169,164	75.1	9.6	41.5	38.1	9.5	1.1	.2
	1930—95,173	68.5	9.3	39.7	38.1	9.6	2.9	.4
	1931—182,695	72.8	29.6	39.8	22.8	7.1	.6	.1
	1932—89,914	71.9	6.0	52.4	37.6	3.9	.1	..
	Ave.—132,998	72.6	15.8	43.2	32.4	7.3	1.1	.2
Coahoma	1928—76,806		13.1	41.5	34.5	9.1	1.5	.3
	1929—100,425	78.4	10.9	43.0	35.8	8.4	1.4	.4
	1930—64,932	67.5	4.5	31.5	47.2	13.2	3.2	.4
	1931—100,076	66.4	16.3	42.9	30.7	9.1	.8	.2
	1932—62,642	70.8	7.1	58.5	32.2	2.2	3/	.
	Ave.—80,976	71.1	11.0	43.4	35.5	8.5	1.3	.3
Holmes	1928—42,871		16.6	22.3	22.3	19.1	11.1	8.6
	1929—Insufficient data							
	1930—Insufficient data							
	1931—42,679	88.6	17.7	25.0	27.2	18.9	9.1	2.1
	1932—33,255	68.7	4.3	49.2	34.2	9.4	2.4	.5
	Ave.—39,602	79.9	13.5	30.8	27.3	16.3	7.9	4.2
Humphreys	1928—37,396		25.0	44.1	25.8	4.3	.5	.3
	1929—50,504	70.2	20.5	50.1	26.0	2.9	.4	.1
	1930—31,605	84.2	22.3	46.4	27.9	2.8	.5	.1
	1931—36,573	88.7	43.1	40.3	14.3	1.8	.4	.1
	1932—27,964	69.9	19.1	62.6	18.0	.3	..	..
	Ave.—36,808	77.8	26.0	48.2	22.7	2.6	.4	.1
Issaquena (See Sharkey Co.)	1928—78,890		25.5	45.0	21.8	5.8	1.5	.4
Leflore	1929—110,901	67.6	13.4	45.7	34.0	5.8	.8	.3
	1930—65,137	78.5	8.0	40.8	40.2	7.9	2.8	.3
	1931—77,923	83.4	9.2	35.2	40.1	13.0	1.6	.9
	1932—48,656	73.1	1.9	49.0	43.6	5.1	.2	.2
	Ave.—76,301	74.9	12.6	43.0	35.0	7.5	1.4	.5

TABLE 2.

Production ¹/₂; grade (Middling White and better); and staple length of cotton ginned in the Yazoo-Mississippi Delta, crop years 1928, 1929, 1930, 1931 and 1932, with averages ²/₃

	Grade			Staple lenth (inches)					
White Mid. 1-3/16 & 1-1/8 & 1-1/16 & 1 & 15/16 Shorter Year Production & better longer 1-5/32 1-3/32 1-1/32 & 31/32 than 7/8									
	Bales	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	
Quitman	1928— 34,666		38.4	35.2	17.6	7.2	.7	.9	
	1929— 47,160	78.8	7.3	39.8	43.8	7.6	1.2	.3	
	1930— 30,326	78.2	6.0	35.7	42.4	12.9	2.6	.4	
	1931— 45,389	74.5	9.7	29.7	35.7	18.5	4.7	1.7	
	1932— 32,251	76.7	13.4	55.0	30.1	1.4	.1	..	
Ave.—	37,958	77.0	14.4	38.5	34.5	9.9	2.0	.7	
Sharkey Issaquena and Warren	1928— 41,586		12.7	36.1	40.6	9.3	1.1	.2	
	1929— 39,638	66.0	11.4	49.9	32.9	5.1	.5	.2	
	1930— 35,990	59.9	3.3	29.6	42.6	15.0	6.6	2.9	
	1931— 50,190	70.3	30.0	38.7	21.2	6.0	2.7	1.4	
	1932— 34,285	58.4	13.7	59.1	19.6	5.6	1.6	.4	
Ave.—	40,338	64.3	15.2	42.3	31.1	8.0	2.4	1.0	
Sunflower	1928— 123,284		22.0	40.5	29.0	6.9	.8	.8	
	1929— 159,837	72.9	12.2	45.5	33.7	7.7	.7	.2	
	1930— 91,216	76.7	6.4	36.6	42.3	11.9	2.5	.3	
	1931— 127,301	81.7	29.7	42.6	23.4	3.9	.3	.1	
	1932— 81,299	75.3	4.9	48.2	41.8	4.9	.2	3/	
Ave.—	116,588	76.5	16.2	42.8	32.9	7.0	.8	.3	
Tallahatchie	1928— 47,264		17.7	39.1	24.6	10.7	4.8	3.1	
	1929— 59,688	67.4	13.6	46.5	32.6	6.3	.7	.3	
	1930— 38,138	68.6	8.7	50.4	34.8	4.8	1.2	.1	
	1931— 50,319	80.2	11.5	50.6	30.0	7.2	.6	.1	
	1932— 28,819	84.9	12.8	50.6	34.0	2.6	3/	.	
Ave.—	44,846	74.1	13.0	47.0	30.9	6.7	1.6	.8	
Tunica	1928— 28,649		8.0	32.2	44.7	13.8	1.2	.1	
	1929— 39,962	69.6	1.7	29.3	43.0	19.5	4.1	2.4	
	1930— 27,403	57.3	.4	13.6	56.9	24.1	4.6	.4	
	1931— 49,124	45.3	12.8	40.7	35.4	10.4	.6	.1	
	1932— 33,025	42.5	3.9	46.7	40.1	8.6	.7	3/	
Ave.—	35,033	53.2	6.1	33.8	42.7	14.7	2.1	.6	
Washington	1928— 75,134		25.3	40.0	28.2	5.7	.6	.2	
	1929— 103,510	65.7	13.6	46.9	35.5	3.5	.4	.1	
	1930— 55,065	63.7	4.7	26.6	43.5	19.2	5.2	.8	
	1931— 80,894	78.6	37.6	37.4	18.4	5.9	.6	.1	
	1932— 60,295	71.0	10.1	54.4	32.4	2.8	.2	.1	
Ave.—	74,980	72.8	19.3	41.6	31.0	6.7	1.2	.2	

TABLE 2.

Production ^{1/}; grade (Middling White and better); and staple length of cotton ginned in the Yazoo-Mississippi Delta, crop years 1928, 1929, 1930, 1931 and 1932, with averages ^{2/}

Year	Production & better	Grade			Staple length (inches)				
		White	Mid.	Shorter	1-3/16 & 1-1/8 & 1-1/16 & 1 & 15/16	1-5/32	1-3/32	1-1/32	31/32 than 7/8
	Bales	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Yazoo	1928— 37,975		17.9	27.8	33.4	14.7	3.8	2.4	
	1929— 40,768	80.1	9.0	39.1	36.1	12.4	2.8	.6	
	1930— 1,121	81.4	2.3	24.3	47.1	20.1	5.6	.6	
	1931— 1,221	48.7	14.6	30.5	35.8	15.4	2.9	.8	
	1932— 1,922	74.4	8.6	54.4	30.9	5.2	.5	.4	
Average— 38,968		80.5	10.8	34.9	36.6	13.7	3.1	.9	

1/ U. S. Dept. of Commerce ginner's report—1932 Preliminary report.

2/ Average: one for two, three, four, or five years, as indicated by data.

3/ Less than 0.1 per cent.

DISTRIBUTION OF STAPLE LENGTHS OF COTTON PRODUCED IN THE YAZOO-MISSISSIPPI DELTA OF MISSISSIPPI; CROPS OF 1928-1932

Percent

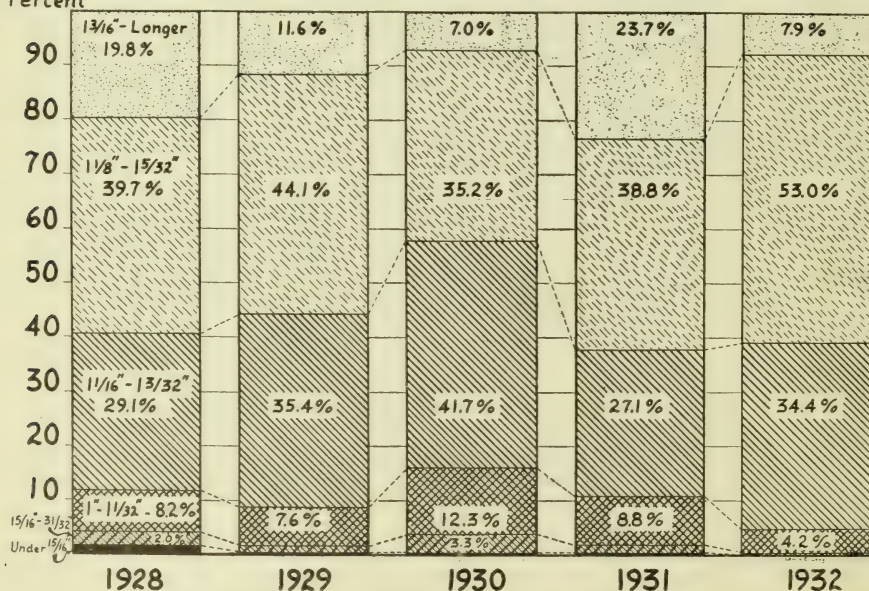


Fig. II. The Yazoo-Mississippi Delta of Mississippi is noted for the production of staple cotton. This area, comprising about 8000 square miles, produces about 60 per cent of the American Upland cotton produced in the United States stapling 1 1/8 inches and longer.

TABLE 3

Production 1/; grade (Middling White and better); and staple length of cotton ginned in the Hill Sections, crop years 1928, 1929, 1930, 1931, and 1932, with averages 2/

		Grade		Staple length (inches)						
Yr.	P'duction	Wht. Mid 1-1/8 & 1-1/16 & 1 & 15/16 & 7/8	1-1/8 & 1-1/16 & 1 & 15/16 & 7/8	1-1/16 & 1 & 15/16 & 7/8	1 & 15/16 & 7/8	15/16 & 7/8	7/8	Shrttr		
		& better longer	1-3/32	1-1/32	31/32	& 29/32	thn 7/8			
		Bales	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent		
Total for Hill Section	1928—	709,457		2.1	3.7	7.6	13.1	37.8	35.7	
	1929—	905,160	77.2	2.0	4.6	10.8	21.6	39.3	21.7	
	1930—	852,351	87.1	1.6	6.8	14.8	28.9	35.0	12.9	
	1931—	830,268	91.1	3.3	7.5	18.6	27.7	34.7	8.2	
	1932—	593,414	70.9	4.2	11.9	25.0	28.0	25.3	5.6	
Ave.—		778,130	82.4	2.5	6.7	15.1	24.0	34.9	16.8	
Adams, Claiborne, Jefferson, and Wilkinson	1928—	20,612		27.5	26.7	21.0	15.4	8.8	.6	
	1929—	26,751	81.6	9.6	21.7	35.1	22.6	10.0	1.0	
	1930—	33,860	82.4	13.3	30.9	27.7	18.6	8.8	.7	
	1931—	37,423	88.9	16.6	27.0	28.1	15.6	12.7	3/	
	1932—	26,805	77.0	15.0	51.8	18.4	7.5	7.1	.2	
Ave.—		29,090	83.0	15.8	31.5	26.5	16.0	9.7	.5	
Alcorn	1928—	13,535		...	.2	.5	2.7	32.5	64.1	
	1929—	16,207	82.9	...	.1	.5	5.8	41.1	52.5	
	1930—	13,628	99.8	...	.1	.5	11.3	56.8	31.3	
	1931—	15,871	98.9	...	.7	3.2	14.0	52.5	29.6	
	1932—	8,374	62.4	.2	3.2	12.0	18.8	52.2	13.6	
Ave.—		13,523	88.7	3/	.6	2.6	9.8	46.6	40.4	
Amite and Franklin	1928—	11,248		.2	1.3	4.8	12.4	40.0	41.3	
	1929—	14,155	63.2	.2	1.4	6.0	22.1	49.0	21.3	
	1930—	17,926	67.7	.1	.7	3.8	22.2	51.8	21.4	
	1931—	19,556	92.0	.2	1.3	8.3	16.2	67.6	6.4	
	1932—	14,552	87.4	.1	1.0	4.8	17.4	60.1	16.6	
Ave.—		15,487	78.3	.1	1.1	5.7	18.4	55.1	19.6	
Attala	1928—	13,415		.6	1.1	2.9	7.7	28.2	59.5	
	1929—	16,138	88.1	.5	3.5	10.7	26.4	43.5	15.4	
	1930—	13,892	97.8	1.3	5.2	19.1	45.2	26.9	2.3	
	1931—	10,231	87.5	1.3	1.7	14.1	28.6	51.7	2.6	
	1932—	10,332	62.6	3.8	10.8	33.7	40.1	10.8	.8	
Ave.—		14,802	85.4	1.4	4.2	15.2	29.1	32.7	17.4	
Benton, Marshall and Lafayette	1928—	32,521		.1	.9	4.3	11.8	50.1	32.8	
	1929—	45,617	80.0	.5	2.3	11.7	27.0	43.4	15.1	
	1930—	34,848	91.6	.3	3.0	10.6	26.5	38.6	21.0	
	1931—	40,305	95.1	1.2	5.5	22.5	42.1	25.6	3.1	
	1932—	29,696	56.1	2.0	11.8	34.5	34.3	15.3	2.1	
Ave.—		36,597	82.0	.8	4.4	16.3	28.7	35.2	14.6	
Calhoun and Webster	1928—	16,547		.2	1.1	6.2	12.2	45.3	35.0	
	1929—	20,803	81.3	.3	1.2	2.5	18.7	60.1	17.2	
	1930—	16,911	93.9	1.0	5.9	14.6	27.2	34.7	16.6	
	1931—	18,535	92.8	1.9	7.7	16.7	26.4	32.3	15.0	
	1932—	12,665	52.1	2.3	14.5	26.7	26.3	24.3	5.9	
Ave.—		17,092	82.1	1.1	5.5	12.3	21.9	40.8	18.4	

TABLE 3

Production 1/; grade (Middling White and better); and staple length of cotton ginned in the Hill Sections, crop years 1928, 1929, 1930, 1931, and 1932, with averages 2/

Yr.	P'duction & better	Grade	Staple length (inches)						
		Wht. Mid 1-1/8 & 1-1/16 & 1 & 15/16 & 7/8	1-1/8 & 1-1/16 & 1 & 15/16 & 7/8	1-1/16 & 1 & 15/16 & 7/8	1 & 15/16 & 7/8	15/16 & 7/8	7/8	Shrttr	
		1-3/32	1-1/32	31/32 & 29/32	thn 7/8	thn 7/8	thn 7/8	thn 7/8	
	Bales	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	
Carroll and Mt'gomery	1928—	18,824		3.8	6.4	14.3	21.7	35.1	18.7
	1929—	23,224	85.7	2.4	7.2	19.4	26.8	38.4	5.8
	1930—	18,483	93.9	3.3	12.1	28.0	33.4	19.0	4.2
	1931—	17,333	93.1	3.5	7.8	22.6	31.1	31.0	4.0
	1932—	11,508	46.0	2.2	18.1	28.0	31.0	18.5	2.2
	Ave.—	17,852	83.2	3.0	9.6	21.8	28.5	29.7	7.4
Chickasaw and Monroe	1928—	31,109		1.6	.9	3.8	13.2	45.7	34.8
	1929—	46,528	88.3	—	.4	9.1	34.1	44.5	11.9
	1930—	30,819	92.6	1.9	11.4	21.0	35.1	25.2	5.4
	1931—	35,949	90.3	.4	5.1	29.8	33.6	27.8	3.3
	1932—	19,389	48.8	6.8	8.9	23.1	34.1	25.1	2.0
	Ave.—	32,769	84.1	1.6	4.6	16.5	30.2	35.1	12.0
Choctaw, Oktibbeha and Winston	1928—	20,942		.1	.3	1.2	10.6	53.7	34.1
	1929—	25,991	71.9	.1	.4	1.8	16.8	58.7	22.2
	1930—	23,115	87.7	.1	.9	5.5	27.2	50.6	15.7
	1931—	19,157	85.2	.4	1.1	6.3	19.2	58.7	14.3
	1932—	13,066	60.3	4.3	9.4	27.7	27.8	26.8	4.0
	Ave.—	20,454	77.7	.7	1.8	6.6	19.7	51.8	19.4
Claiborne (See Adams Co.)									
Clarke, Jasper, Jones, and Wayne	1928—	35,390		.4	1.0	2.0	7.6	49.7	39.3
	1929—	41,820	81.1	.1	1.6	2.3	14.4	55.9	25.7
	1930—	54,085	75.8	.1	.8	6.8	30.0	48.7	13.6
	1931—	43,359	93.1	.2	2.4	9.1	30.6	48.6	9.1
	1932—	30,110	80.7	.1	1.7	18.8	42.2	34.5	2.7
	Ave.—	40,953	82.5	.2	1.5	7.3	24.8	48.3	17.9
Clay	1928—	8,275		.2	1.1	5.9	17.8	51.3	23.7
	1929—	11,614	97.2	.8	9.1	19.7	20.4	33.5	16.5
	1930—	6,639	97.7	.4	9.6	20.8	34.5	26.0	8.7
	1931—	10,049	97.4	2.2	8.6	25.4	30.2	30.7	2.9
	1932—	5,754	65.5	...	1.5	29.9	43.8	21.2	3.6
	Ave.—	8,466	92.3	.9	6.5	19.9	27.6	33.4	11.7
Copiah	1929—	Insufficient data							
	1928—	7,574		6.6	18.1	29.3	23.3	19.9	2.8
	1930—	9,306	95.9	4.1	19.7	35.6	25.7	12.4	2.5
	1931—	11,642	97.7	25.6	33.9	24.2	12.5	3.6	.2
	1932—	8,579	92.0	12.1	32.6	37.5	15.4	2.3	.1
	Ave.—	9,275	95.5	13.2	26.8	31.2	18.7	8.8	1.3
Covington	1928—	12,749		.1	1.7	3.8	10.2	56.2	28.0
	1929—	12,913	76.7	.2	.3	1.9	16.6	58.9	22.1
	1930—	18,413	88.0	.4	.6	5.4	17.5	42.3	33.8
	1931—	13,472	90.3	.9	5.3	7.5	17.7	44.6	24.0
	1932—	11,230	77.2	.8	10.8	26.4	28.4	28.8	4.8
	Ave.—	13,756	83.7	.5	3.3	8.3	17.8	46.2	23.9

TABLE 3

Production 1/; grade (Middling White and better); and staple length of cotton ginned in the Hill Sections, crop years 1928, 1929, 1930, 1931, and 1932, with averages 2/

Yr.	Grade		Staple length (inches)						
	P'duction	& better	Wht. Mid	1-1/8 &	1-1/16 &	1 &	15/16 &	7/8	Shrttr
			1-3/32	1-1/32	31/32 &	29/32	7/8	Shrttr	7/8
	Bales	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
De Soto	1928—Insufficient data								
	1930—Insufficient data								
	1929—32,288	72.4	19.6	19.7	24.4	26.1	10.1	.1	
	1931—35,034	76.6	20.4	17.6	24.5	24.4	12.8	.3	
	1932—27,248	75.0	18.3	22.4	41.3	17.1	.9	...	
	Ave.—31,523	74.3	19.5	19.7	29.3	22.9	8.4	.2	
Forrest	1928—9,632		.4	1.3	1.9	14.3	51.6	30.5	
George, Gr'n,	1929—9,525	67.7	.2	.2	.9	19.1	59.8	19.8	
Perry and	1930—12,498	84.5	...	...	.7	11.3	63.9	24.1	
all other	1931—10,826	94.8	.8	6.2	11.1	27.8	49.3	4.8	
	1932—5,986	29.3	...	3.3	8.0	39.4	36.0	13.3	
	1931—35,034	75.6	20.4	17.6	24.5	24.4	12.8	.3	
	Ave.—9,687	75.2	.3	2.1	4.2	20.6	53.9	18.9	
Franklin (See Amite Co.)									
George (See Forrest Co.)									
Greene (See Forrest Co.)									
	1928—16,842		1.9	6.7	19.7	24.1	31.5	16.1	
Grenada	1929—24,200	90.2	3.6	6.4	14.5	28.9	38.6	8.0	
and	1930—17,379	90.7	4.7	23.9	33.3	27.1	10.8	.2	
Yalobusha	1931—20,306	93.1	2.6	14.6	36.2	34.3	12.2	.1	
	1932—10,856	58.2	.7	16.9	44.8	34.7	2.9	...	
	Ave.—17,917	86.4	2.9	13.0	27.7	29.7	21.5	5.2	
	1928—25,896		8.6	18.8	28.3	25.0	17.3	2.0	
Hinds	1929—30,084	72.3	9.8	22.4	31.2	26.1	10.2	.3	
	1930—29,738	88.5	7.7	29.5	39.1	20.2	3.3	.2	
	1931—33,198	81.8	8.4	30.0	40.2	16.4	4.8	.2	
	1932—30,556	70.7	3.6	27.4	51.4	16.4	1.2	...	
	Ave.—29,894	78.4	7.6	25.9	38.4	20.6	7.0	.5	
	1928—29,997		3/	.4	2.2	5.8	28.6	63.0	
Ittawamba,	1929—37,298	69.9	.1	.3	.2	5.3	30.4	63.8	
Prentiss,	1930—33,554	96.4	3/	.5	2.6	18.8	41.3	36.8	
and	1931—40,102	95.2	.1	.1	2.6	12.9	46.2	38.1	
Tishomingo	1932—23,385	50.0	.1	1.4	8.2	27.8	47.7	14.8	
	Ave.—32,867	80.6	3/	.5	2.8	13.2	38.6	44.9	
Jasper (See Clarke Co.)									
Jefferson (See Adams Co.)									
Jones (See Clarke Co.)									
	1928—11,608		.1	.2	1.7	5.9	40.3	51.8	
Jefferson	1929—14,189	75.8	...	.1	3.2	14.0	49.3	33.4	
Davis	1930—17,535	66.1	...	.1	7.0	27.2	47.8	17.9	
	1931—14,824	95.0	...	...	1.7	14.2	61.7	22.4	
	1932—12,985	89.1	...	1.1	10.7	35.8	44.8	7.6	
	Ave.—14,228	80.6	3/	.3	5.0	19.9	49.2	25.6	

TABLE 3

Production 1/; grade (Middling White and better); and staple length of cotton ginned in the Hill Sections, crop years 1928, 1929, 1930, 1931, and 1932, with averages 2/

		Grade		Staple length (inches)					
		Wht.	Mid.	1-1/8	1-1/16	1	15/16	7/8	Shorter
		Yr. Production & better longer 1-3/32 1-1/32 31/32 & 29/32 than 7/8							
	Bales	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Kemper and Lauderdale	1928—	23,033		.2	1.1	2.5	8.7	39.4	48.1
	1929—	27,646	71.2	.1	.9	2.0	12.6	52.4	32.0
	1930—	35,222	87.4	.2	.6	8.9	38.0	44.5	7.8
	1931—	22,535	75.8	.1	2.5	8.0	22.6	59.0	7.8
	1932—	13,985	69.8	1.2	1.5	9.7	39.5	46.0	2.1
	Ave.—	24,484	77.8	.3	1.2	6.1	24.1	48.1	20.2
Lafayette (See Benton Co.)									
Lamar, Marion and Walthall	1928—	24,730		.1	.1	1.3	5.3	48.1	45.1
	1929—	30,562	78.6	.1	.1	.8	10.4	59.3	29.3
	1930—	41,898	80.3	.2	1.2	4.6	24.4	53.4	16.2
	1931—	36,306	92.6	.3	2.1	6.0	23.4	58.4	9.8
	1932—	29,683	90.4	.2	1.8	9.3	21.5	39.3	27.9
	Ave.—	32,636	85.3	.2	1.2	4.5	18.1	52.3	23.7
Lauderdale (See Kemper Co.)									
Lawrence	1928—	10,990		...	...	1.2	3.5	33.4	61.9
	1929—	12,965	78.2	...	.2	.7	7.9	51.2	40.0
	1930—	15,680	77.4	...	.5	6.5	30.8	45.9	16.3
	1931—	13,725	94.1	.4	1.7	10.6	30.8	46.6	9.9
	1932—	10,416	86.6	...	.2	1.3	7.6	61.8	29.1
	Ave.—	12,755	83.8	.1	.6	4.4	17.6	47.6	29.7
Leake	1928—	17,965		.1	.7	2.1	7.5	52.9	36.7
	1929—	21,014	85.4	.7	1.5	3.1	12.8	49.8	32.1
	1930—	19,066	95.9	.1	.1	4.9	34.3	52.4	8.2
	1931—	16,129	92.0	...	...	2.2	28.1	65.3	4.4
	1932—	11,824	92.4	9.7	8.7	22.5	43.6	15.5	...
	Ave.—	17,200	91.1	1.5	1.7	5.8	23.6	49.2	18.2
Lee	1928—	25,599		.1	1.9	7.5	21.2	38.2	31.1
	1929—	36,405	71.7	.5	6.0	18.8	38.0	31.2	5.5
	1930—	27,299	86.1	1.3	7.2	24.1	41.0	23.7	2.7
	1931—	27,596	96.0	1.1	5.3	40.0	35.5	17.0	1.1
	1932—	17,516	52.5	.7	4.3	30.4	49.8	14.7	.1
	Ave.—	26,883	78.4	.8	5.1	23.6	36.4	25.9	8.2
Lincoln	1928—	10,574		.2	1.0	4.1	9.7	42.9	42.1
	1929—	13,178	82.2	...	.6	4.0	18.0	52.4	25.0
	1930—	15,108	84.5	.1	.5	6.9	30.7	43.5	18.3
	1931—	11,635	87.0	...	.5	4.2	40.6	47.9	6.8
	1932—	11,044	91.0	.1	.6	4.0	37.9	49.1	8.3
	Ave.—	12,308	85.9	.1	.6	4.8	27.5	47.1	19.9
Lowndes	1928—	13,581		.2	1.5	2.8	11.5	43.5	40.5
	1929—	Insufficient data.							
	1930—	14,940	96.3	.1	.3	10.0	28.8	40.1	20.7
	1931—	18,689	96.5	...	.2	5.9	30.2	52.4	11.3
	1932—	10,359	58.7	...	.2	8.5	34.8	51.1	5.4
	Ave.—	14,392	87.5	.1	.5	6.7	26.2	46.9	19.6

TABLE 3

Production 1/; grade (Middling White and better); and staple length of cotton ginned in the Hill Sections, crop years 1928, 1929, 1930, 1931, and 1932, with averages ^{2/}

Yr.	Grade		Staple length (inches)						
	P'duction	& better	Wht.	Mid 1-1/8 &	1-1/16 & 1-3/32	1 & 1-1/32	15/16 & 31/32	7/8 & 29/32	Shrt'r thn 7/8
	Bales	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	
Madisor	1928— 28,434		11.0	15.7	26.7	23.3	18.5	4.8	
	1929—	Insufficient data							
	1930— 25,916	89.6	7.0	23.1	34.1	29.4	6.3	.1	
	1931— 26,207	91.0	10.7	23.0	39.9	21.3	4.9	.2	
	1932— 23,743	90.2	17.5	23.7	39.4	17.9	1.5	3/	
	Ave.— 26,075	90.3	11.4	21.2	34.7	23.1	8.2	1.4	
Marion.....(See Lamar Co.)									
Marshall.....(See Benton Co.)									
Monroe.....(See Chickasaw Co.)									
Montgomery....(See Carroll Co.)									
Neshoba	1928— 20,651	....	....	.3	.9	2.9	27.7	68.2	
	1929— 23,834	58.1	.4	2.5	3.9	9.7	31.8	51.7	
	1930— 23,209	87.9	.2	3.5	16.0	44.6	31.2	4.5	
	1931— 16,710	96.2	1.1	9.8	25.9	33.5	27.3	2.4	
	1932— 10,331	61.8	.1	.4	9.2	40.2	47.3	2.8	
	Ave.— 18,947	76.9	.4	3.3	10.7	24.3	31.6	29.7	
Newton	1928— 18,675	....	....	.7	1.1	4.0	30.2	64.0	
	1929— 22,202	55.8	.5	.6	3.5	28.2	46.4	20.8	
	1930— 22,994	96.1	.3	.8	5.7	38.7	47.7	6.8	
	1931— 16,348	92.9	.3	.7	10.3	38.6	46.1	4.0	
	1932— 11,464	75.2	.7	2.6	3.6	29.9	57.2	6.0	
	Ave.— 18,337	79.8	.3	.9	4.8	28.0	44.7	21.3	
Noxubee	1928— 14,428	....	.1	....	1.9	9.3	49.3	39.4	
	1929— 20,810	83.3	.2	1.1	10.6	34.4	41.8	11.9	
	1930— 20,173	85.3	.3	2.6	13.0	41.8	39.3	3.0	
	1931— 16,967	87.9	....	1.9	21.7	47.6	27.6	1.2	
	1932— 10,555	47.9	.2	1.3	8.7	52.1	35.7	2.0	
	Ave.— 16,587	79.6	.2	1.5	11.7	36.8	38.7	11.1	
Oktibbeha.....(See Choctaw Co.)									
Panola	1928— 25,348	....	.5	4.1	17.7	32.2	40.5	5.0	
	1929— 33,655	87.1	.7	8.5	28.4	42.5	18.6	1.3	
	1930— 25,437	85.8	1.4	19.1	34.9	31.1	12.9	.6	
	1931— 28,383	88.0	1.8	11.5	42.6	36.4	7.7	....	
	1932— 24,912	65.1	12.5	24.8	42.7	17.0	2.9	.1	
	Ave.— 27,549	82.2	3.2	13.2	33.0	32.7	16.5	1.4	
Perry——(See Forrest Co.)									
Pike	1928— 11,255	....	3.7	7.7	13.3	23.5	35.6	16.2	
	1929— 14,138	60.2	2.5	14.9	26.8	27.3	20.9	7.6	
	1930— 16,631	61.6	.9	7.8	24.8	29.6	28.2	8.7	
	1931— 15,381	95.0	2.5	6.6	20.3	32.0	34.6	4.0	
	1932— 11,056	87.2	.2	3.6	13.4	15.9	56.4	10.5	
	Ave.— 13,692	75.3	1.9	8.3	20.5	26.5	33.9	8.9	

TABLE 3

Production 1/; grade (Middling White and better); and staple length of cotton ginned in the Hill Sections, crop years 1928, 1929, 1930, 1931, and 1932, with averages 2/

Yr.	Grade		Staple length (inches)					
	P'duction	Wh't. Mid 1-1/8 & 1-1/16 & 1 & 15/16 & 7/8	longer	1-3/32	1-1/32	31/32 & 29/32	thn 7/8	Shorter
	Bales	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Tippah	1928— 15,956	...	...	.2	.6	1.9	18.5	78.8
	1929— 22,105	91.0	...	...	1.0	5.6	31.1	62.3
	1930— 17,335	94.8	...	.4	4.0	20.1	41.9	33.6
	1931— 19,393	99.2	...	.2	4.0	22.9	48.0	24.9
	1932— 10,514	73.0	.7	4.6	12.2	25.3	50.4	6.8
	Ave.— 17,061	91.5	.1	.7	3.6	14.2	37.2	44.2
Union	1928— 11,712	...	....	....	.6	3.1	29.5	66.8
	1929— 17,173	76.5	....	....	.6	6.8	47.3	45.3
	1930— 14,421	93.7	...	.3	3.2	31.6	53.7	11.2
	1931— 14,509	99.8	...	.7	3.6	26.8	48.6	20.3
	1932— 9,222	51.6	...	2.6	9.9	22.8	43.8	20.9
	Ave.— 13,407	82.9	...	.6	3.1	18.0	45.4	32.9
Walthall.....(See Lamar Co.)								
Wayne.....(See Clarke Co.)								
Webster.....(See Calhoun Co.)								
Wilkinson.....(See Adams Co.)								
Winston.....(See Choctaw Co.)								
Yalobusha....(See Grenada Co.)								

1/ U. S. Dept. of Commerce ginners' report—1932 Preliminary report.

2/ Average are for two, three, four, or five years, as indicated by data

3/ Less than 0.1 per cent.

DISTRIBUTION OF STAPLE LENGTHS OF COTTON PRODUCED IN THE HILL SECTIONS OF MISSISSIPPI; CROPS OF 1928-1932

Percent

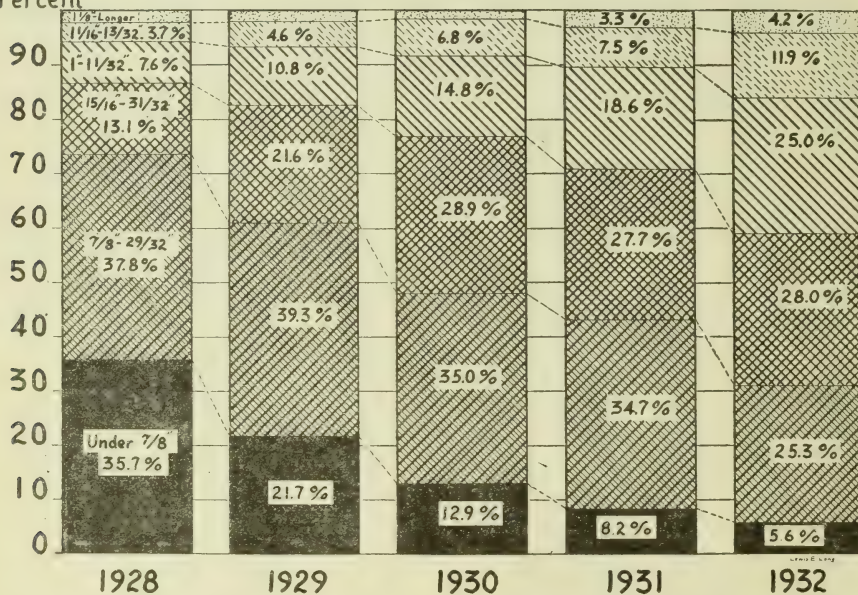


Fig.III-A marked improvement occurred in the staple length of cotton produced in the Hill Sections of Mississippi during the 5-year period, 1928-1932. Much of this improvement may be attributed to more accurate information pertaining to the quality of cotton grown in the several communities.

CHANGES IN STAPLE LENGTH OF COTTON PRODUCED IN MISSISSIPPI; CROPS OF 1928-1932

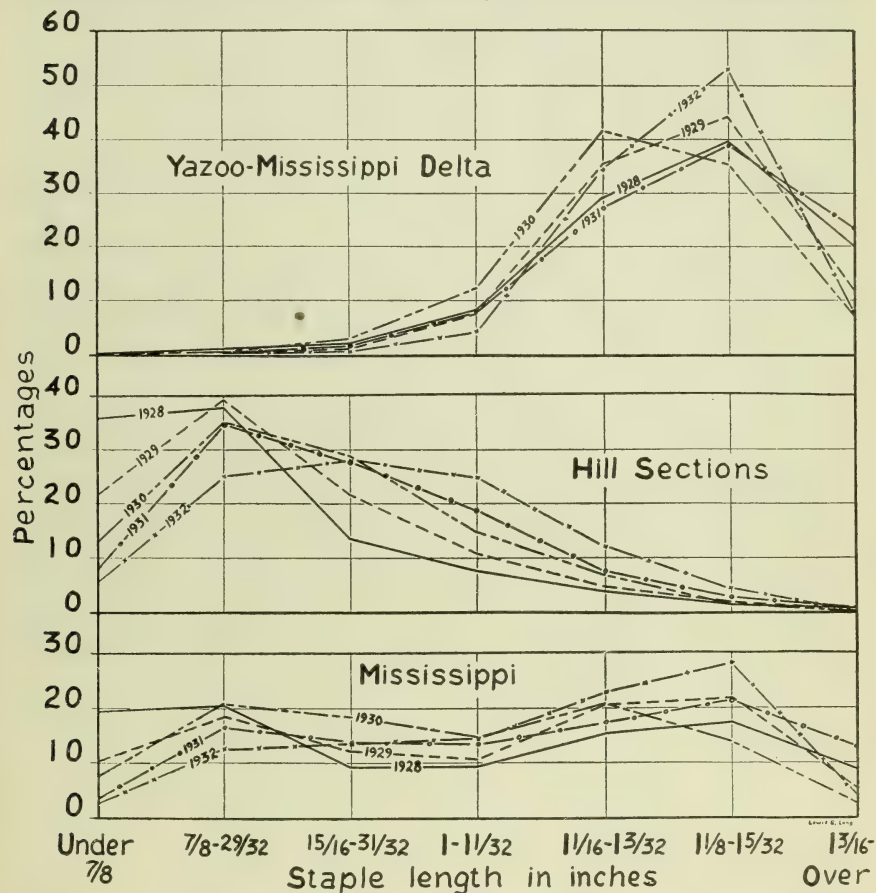


Fig. IV.—The modal length of staple has shifted upward in both the Yazoo-Mississippi Delta and the Hill Sections during the past five years. Two modes formerly occurred for the state, but the valley between the peaks has been eliminated.

It is common knowledge among cotton producers that the principal factor contributing to length of staple is the variety planted. Not only do the several varieties vary among themselves as to staple length, but any particular variety shows variations over a period of years, while still retaining its varietal name, because of biological and mechanical changes in the purity of seed stocks from year to year. Lesser factors influencing staple length are soil fertility, climatic conditions and mechanical shortening of some fibers in the ginning process.

As a means of determining the approximate extent to which cotton varieties contributed to the improvement in staple length, a survey was made of the varieties produced in the state. Table 4 shows the principal varieties produced in the Yazoo-Mississippi Delta by counties and by years for the 5 year period, 1928-1932, while Table 5 shows the same data for the Hill Sections for the 4-year period 1928-1931.

By applying to the varieties grown the staple lengths as reported by the Mississippi Agricultural Experiment Station, it is evident that the improvement in staple length is due primarily to shifting to varieties of longer staple while doubtless more care in keeping these varieties pure and improvement in ginning technique, such as the installation of cotton dryers, may have exerted some influence.

VARIETIES

From the tables showing varieties grown, it may be seen that marked changes occur from year to year in the proportions of the different varieties grown. In many cases, this shift is only to an improved strain of the same variety or to a related variety having sufficient superior qualities as to merit a new varietal designation. Thus, in the Yazoo-Mississippi Delta (Table 4), Delfos, a selection of Foster with a name derived from a shortening of the words "Delta Foster," has given away to Missdel, a selection of Delfos with a name derived from a shortening of the words "Mississippi Delfos."

On the other hand, and especially in the Hill Sections (Table 5) shifts have been made to wholly unrelated varieties. For example, the proportion of Half and Half reported, a typically short staple variety, decreased from 45.6 per cent in 1928 to 22.4 per cent in 1931. During the same period, the proportion of Delta and Pine Land cotton, stapling from 15/16 to 1 inch, increased from 11.2 per cent to 31.5 per cent. Similar shifts from a short staple variety to a medium length staple variety may be noted in practically every county or group of counties shown.

The percentages shown in Tables 4 and 5 are based on bales ginned.

Figure V shows graphically the relationship between the weighted average variety staple length and the staple length as determined by actual classification of cotton samples selected to represent production in the crop of each year 1928 to 1932. The weighted average variety staple length was arrived at by application of staple lengths, as found

by the State Experiment Station, to the number of bales produced from each variety. The classification staple length was arrived at by the use of actual staple designations made by Government classers, weighted by the number of bales which they found in each respective staple in their classification of samples selected to represent each crop. Varieties listed in Tables 4 and 5 under "All Others" includes cotton listed by ginners as "Gin Run" and also include miscellaneous varieties comprising less than one per cent of the production. The staple length assigned to cotton produced from "Gin Run" seed was an estimated modal staple length for the community.

It will be observed that staple lengths based on Experiment Station measurements are consistently and uniformly longer than those as determined by cotton classers. This may be accounted for when it is considered that Station measurements are made by combing the lint and measuring it on the seed or immediately after it has been pulled off the seed by hand, and that the variety so measured is of pure stock; while samples as classed by Government classers have been subjected to varying degrees of gin cutting and consist of samples grown from seed stocks of all degrees of degeneration.

The remarkable progress which Mississippi has made in the improvement of staple length has increased the value of the state's cotton crop several millions of dollars, although unfortunately this gain has been dissipated in declining prices and premiums. As cotton returns to a parity in purchasing power, this gain will be evident. Improvement will, of necessity, occur at a lower rate as optimum conditions are approached, but some further improvement should occur, especially in particular counties. In many counties, practically 100 per cent of the cotton produced staples as long as is consistent with good yields on the prevailing types of soil. Such counties should retain their favorable position by continued allegiance to improved varieties and careful handling of the crop while those counties still showing marked proportions of short staple varieties should continue their efforts to improve their cotton by the introduction and retention of improved varieties and strains. Thus will Mississippi add to her reputation for the production of uniformly high quality cotton, and benefits accrue to her cotton producers and the state at large.

**COMPARISON OF VARIETAL STAPLE LENGTH
AS DETERMINED BY THE EXPERIMENT STATION
AND AVERAGE STAPLE LENGTH AS DETERMINED
BY LICENSED GOVERNMENT COTTON CLASSERS
MISSISSIPPI; CROPS OF 1928-1932**

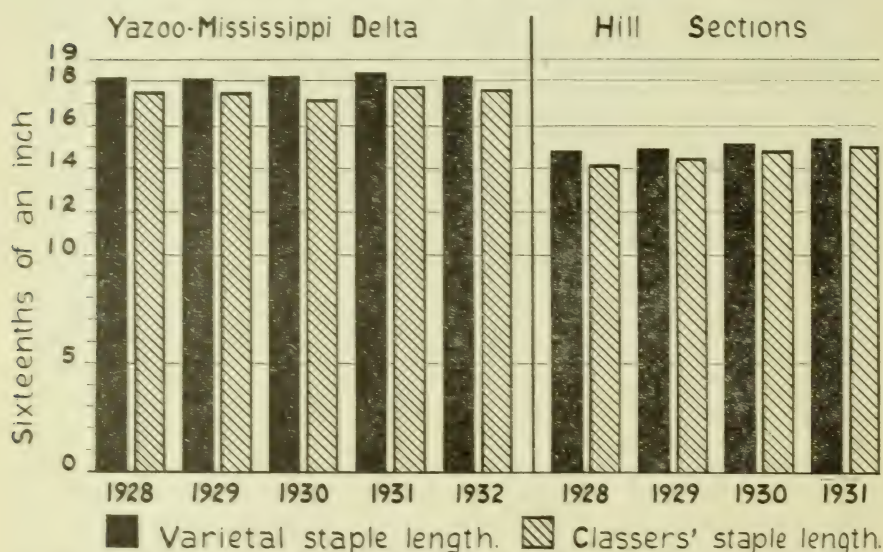


Fig.V. Staple length of varieties is determined by the Experiment Station by combing and measuring the lint before ginning while it is determined by classers after ginning. The consistent differences may result from cutting of fibers in the ginning process and differences in the purity of the samples classed.

TABLE 4

Varieties of Cotton Grown in the Yazoo-Mississippi Delta ^{1/}
Crop years 1928, 1929, 1930, 1931, and 1932

Variety		1928	1929	1930	1931	1932
		Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
Yazoo-Mississippi Delta	D & P L.....	3.2	3.0	3.3	2.7	3.5
	Missdel	3.1	12.2	24.5	38.6	54.1
	Missdel No. 3.....	...	...	...	.2	1.6
	Delfos	70.9	61.0	46.3	26.9	13.1
	Delfos No. 531.....	...	...	...	.5	5.1
	Express	4.4	3.9	4.0	3.5	2.7
	Hartsville	2.9	2.1	1.3	.8	.2
	Webber	7.7	6.8	5.1	4.1	2.2
	Wilds	1.1	3.9	9.3	18.5	8.9
	All other	6.7	7.1	6.2	4.2	3.6
Bolivar Co.	D & P L.....	10.1	10.2	10.6	8.6	13.2
	Missdel	8.2	10.3	14.5	20.6	42.8
	Missdel No. 3.....	...	...	...	.1	1.4
	Delfos	56.5	57.6	51.7	34.6	22.0
	Delfos No. 531.....	...	...	...	...	1.7
	Express	4.0	3.0	2.4	1.2	.9
	Hartsville	6.9	4.3	2.4	2.0	.6
	Webber	7.5	6.4	5.9	3.8	1.1
	Wilds	2.5	4.7	10.1	26.5	13.9
	All other	4.3	3.5	2.4	2.6	2.4
Coahoma Co.	Missdel	3.0	28.0	41.4	60.9	76.6
	Missdel No. 3.....	...	...	...	.4	2.2
	Delfos	83.4	58.1	39.8	20.1	13.8
	Webber	4.4	2.9	2.2	.5	.2
	Wilds	1.1	3.8	8.7	13.9	5.8
	All other	8.1	7.2	7.9	4.2	1.4
Holmes Co.	Half & Half	4.5	5.3	4.3	1.3	.6
	Cleveland	1.8	2.4	2.5	1.3	.9
	Stoneville	...	...	.1	.4	1.8
	D & P L.....	3.2	5.4	6.0	5.1	4.0
	Missdel	.9	6.0	12.0	22.0	36.8
	Missdel No. 3.....	...	...	...	.2	1.6
	Delfos	55.2	45.0	38.5	21.3	22.3
	Express	15.9	18.2	17.9	22.6	13.5
	Webber	12.6	9.7	8.2	11.7	6.3
	Wilds	.8	2.1	5.3	8.5	6.7
	All other	5.1	5.9	5.2	5.6	5.0
Humphreys Co.	Missdel	2.3	15.2	26.7	37.4	47.7
	Missdel No. 3.....	...	...	...	...	.6
	Delfos	68.4	55.9	34.8	21.2	18.6
	Delfos No. 531	...	...	...	.3	5.6
	Express	4.2	3.4	3.8	2.4	2.6
	Webber	10.9	9.3	10.0	11.1	4.8
	Wilds	.5	14.6	22.0	25.1	19.1
	All other	13.7	1.6	2.7	2.5	1.0

TABLE 4

Varieties of Cotton Grown in the Yazoo-Mississippi Delta ^{1/}
Crop years 1928, 1929, 1930, 1931, and 1932

Variety		1928	1929	1930	1931	1932
		Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
Issaquena (See Sharkey Co.)	Cleveland	4.1	3.8	3.3	1.2	.2
	Missdel	.9	10.4	25.6	41.8	53.3
	Missdel No. 3	...	...	...	...	.7
Leflore Co.	Delfos	74.6	69.1	56.2	33.9	30.6
	Delfos No. 531.....	...	...	...	.5	2.6
	Foster	2.9	2.9	3.2	4.4	4.0
	Express ..	4.5	3.9	3.3	3.2	3.6
	Webber ..	7.3	3.8	2.2	1.9	1.0
	Wilds ..	1.9	2.4	3.7	11.6	3.5
	All other	3.8	3.7	2.5	1.5	.5
	D & P L.....	7.0	5.7	5.7	1.4	.6
	Missdel	1.1	8.5	29.9	49.9	69.2
	Missdel No. 3.....	...	...	...	...	.7
Quitman Co.	Delfos ..	76.5	66.9	45.1	25.8	13.3
	Express ..	3.9	3.8	2.9	1.4	.9
	Hartsville ..	3.8	2.6	1.4	.5	...
	Webber ..	4.1	5.2	2.2	1.8	.7
	Wilds ..	...	1.2	6.8	13.5	5.9
	All other	3.6	6.1	6.0	5.7	8.7
	Half & Half	2.2	2.1	2.3	1.4	.3
	D & P L	...	...	1.1	2.5	4.0
Sharkey, Issaquena and Warren Cos.	Missdel ..	1.3	6.2	14.3	31.8	49.1
	Missdel No. 3.....	...	...	...	.4	1.9
	Delfos ..	75.3	70.0	60.3	35.9	15.7
	Delfos No. 531.....	...	...	...	3.2	14.3
	Webber ..	7.5	8.7	3.3	1.6	1.3
	Wilds ..	.5	7.1	15.8	14.8	8.2
	All other	13.2	5.9	2.9	8.4	5.2
	Missdel ..	2.3	10.5	25.5	41.9	66.1
	Missdel No. 3.....	...	...	...	.1	1.7
	Delfos ..	76.1	63.1	49.4	24.9	15.1
	Delfos No. 531.....	...	...	...	...	.8
Sunflower Co.	Express ..	2.3	1.6	1.4	1.0	.2
	Hartsville ..	4.6	3.6	3.3	1.8	.5
	Webber ..	10.7	9.5	6.5	4.9	1.9
	Wilds ..	.5	3.7	8.3	23.2	11.2
	All other	3.5	8.0	5.6	2.2	2.5
	Cleveland ..	3.5	2.2	3.2	2.0	.1
	D & P L	4.5	3.2	3.0	2.1	2.6
	Missdel ..	2.2	15.2	33.8	42.1	52.9
	Missdel No. 3.....	...	...	...	.1	1.4
Tallahatchie Co.	Delfos ..	60.2	54.0	36.5	23.1	19.3
	Express ..	7.5	6.1	4.1	6.0	5.5
	Hartsville ..	3.7	3.4	2.9	1.2	.1
	Webber ..	11.0	9.4	7.2	7.6	7.3
	Wilds ..	.2	1.0	5.3	12.9	7.1
	All other	7.2	5.5	4.0	2.9	3.7

TABLE 4

Varieties of Cotton Grown in the Yazoo-Mississippi Delta^{1/}
Crop years 1928, 1929, 1930, 1931, and 1932

Variety		1928	1929	1930	1931	1932
		Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
Tunica Co.	Missdel ..	1.6	11.9	49.9	64.1	77.7
	Missdel No. 3 ..	...	...	...	...	.6
	Delfos ..	89.8	80.6	41.1	23.0	14.0
	Wilds ..	...	.5	2.4	7.7	3.8
	All other ..	8.6	7.0	6.6	5.2	3.9
Warren Co. (See Sharkey Co.)						
Washington Co.	Stoneville ..	...	1.7	3.3	2.3	.4
	D & P L ..	...	...	2.5	.4	.7
	Missdel ..	.6	13.2	21.8	37.5	42.0
	Missdel No. 3 ..	...	...	...	.4	4.1
	Delfos ..	88.4	64.4	44.5	23.7	14.1
Yazoo Co.	Delfos No. 531 ..	...	...	...	2.5	27.7
	Webber ..	4.0	7.0	5.3	2.7	1.4
	Wilds ..	1.2	5.2	17.6	29.1	6.8
	All other ..	5.8	8.5	5.0	1.4	2.8
	Half & Half ..	1.4	1.4	1.5	1.3	.2
Yazoo Co.	Cleveland ..	1.9	4.5	4.7	1.8	.7
	Stoneville ..	.2	.5	.7	1.4	1.9
	D & P L ..	1.0	2.4	3.9	6.1	9.8
	Missdel ..	.5	3.4	8.3	21.6	27.3
	Missdel No. 3 ..	...	...	...	.1	.2
Yazoo Co.	Delfos ..	67.4	56.8	45.4	24.1	17.8
	Delfos No. 531 ..	...	...	...	.2	8.0
	Express ..	15.4	18.0	20.3	18.9	14.1
	Webber ..	8.2	8.4	6.9	9.0	5.5
	Wilds ..	...	1.2	5.6	13.5	10.7
Yazoo Co.	All other ..	4.0	3.4	2.7	2.0	3.8

1/ Varieties indicated include all strains except where particular strains have shown marked increase during the period of this study. So-called gin run and other miscellaneous varieties comprising less than one per cent are included in "All Others."

TABLE 5

Varieties of Cotton grown in Mississippi Hill Section 1/
crop years 1928, 1929, 1930, 1931, and 1932

Variety		1928 Per ct.	1929 Per ct.	1930 Per ct.	1931 Per ct.
Hill Section	Half & Half	45.6	39.4	32.5	22.4
	Cleveland	5.8	5.1	4.4	3.0
	Red Leaf	2.0	3.1	5.5	5.7
	Miller ..	4.4	4.2	3.7	4.1
	Stoneville ..	...	.1	.5	2.7
	D & P L	11.2	18.7	25.1	31.5
	Missdel ..	.3	.8	1.6	4.9
	Delfos ..	15.3	14.9	13.4	11.5
	All other	15.4	13.7	13.3	14.2
Adams, Clai- borne, Jeffer- son and Wilk- erson Cos.	Half & Half	15.1	10.8	8.0	5.0
	King ..	8.3	9.3	2.8	2.7
	Brandon ..	3.7	4.2	3.8	3.0
	Cleveland ..	5.2	5.1	5.6	4.5
	D & P L	12.6	18.2	25.1	27.3
	Missdel ..	...	.6	3.0	8.4
	Delfos ..	49.7	44.3	44.6	40.1
Alcorn Co.	All other	5.4	7.5	7.1	9.0
	Half & Half	77.5	73.3	65.0	51.2
	Cleveland ..	.9	2.0	3.2	1.8
	Miller ..	7.1	7.9	9.5	8.3
	Stoneville ..	...	...	.3	14.8
	D & P L	1.3	4.1	7.7	7.4
	Delfos ..	1.0	1.6	2.1	1.4
Amite and Franklin Cos.	All other	12.2	11.1	12.2	15.1
	Half & Half	35.3	35.0	31.7	22.2
	Rucker ..	1.8	1.0	1.5	2.8
	Brandon ..	23.2	19.9	17.6	11.4
	Red Leaf ..	...	...	...	3.8
	D & P L	13.9	17.2	22.5	30.2
	Delfos ..	15.3	13.9	13.7	10.8
Attala Co.	All other	10.5	13.0	13.0	18.8
	Half & Half	29.3	31.9	17.7	6.8
	Cleveland ..	23.5	21.7	19.6	15.7
	D & P L	4.7	7.2	20.7	30.8
	Missdel ..	...	...	2.1	5.0
	Delfos ..	21.3	18.2	15.9	14.2
	Wilds ..	...	...	4.5	10.9
Benton, Mar- shall, and La- fayette Co's.	All other	21.2	21.0	19.5	16.6
	Half & Half	48.2	42.0	31.3	23.0
	Cleveland ..	2.7	2.4	2.2	2.3
	Miller ..	1.6	2.3	4.6	6.3
	D & P L	11.6	11.8	15.0	24.6
	Stoneville ..	...	...	.4	1.8
	Lone Star ..	5.2	3.5	2.8	2.2
	Missdel ..	.3	.3	.7	3.4
	Delfos ..	15.3	20.9	20.9	19.9
	All other	15.1	16.8	22.1	16.5

TABLE 5

Varieties of Cotton grown in Mississippi Hill Section ^{1/}
crop years 1928, 1929, 1930, 1931, and 1932

Variety		1928 Per ct.	1929 Per ct.	1930 Per ct.	1931 Per ct.
Calhoun and Webster Co's.	Half & Half	68.9	57.5	40.2	28.1
	Cleveland	2.8	2.9	5.5	4.3
	Miller ..	6.9	11.0	14.8	9.9
	Stoneville ..	...	...	7.1	11.6
	D & P L	1.9	4.7	7.0	11.2
	Missdel ..	...	...	2.6	15.1
	Delfos ..	14.9	18.2	22.0	9.3
	All other	4.6	5.7	7.8	10.5
Carroll and Montg'ery Cos.	Half & Half	36.3	33.7	30.3	22.0
	King ..	2.6	1.6	.8	.1
	Cleveland ..	9.0	8.3	5.8	5.7
	D & P L	1.9	4.3	9.5	15.7
	Missdel ..	...	...	3.2	13.3
	Delfos ..	29.6	32.9	34.6	26.7
	All other	20.6	19.2	15.8	16.5
Chickasaw and Monroe Cos.	Half & Half	39.8	34.7	25.5	23.9
	Addison's Prolific	3.2	2.6	4.0	4.4
	Cleveland ..	8.6	8.1	7.2	3.9
	Miller ..	19.6	19.0	17.5	17.5
	D & P L	6.4	13.6	25.4	25.6
	Delfos ..	11.8	13.0	10.5	6.4
	Webber ..	2.1	1.7	1.8	2.0
	All other	8.5	7.3	8.1	16.3
Choctaw Ok- tibehe and Winston Cos.	Half & Half	43.5	40.0	25.5	10.6
	Rucker ..	9.4	8.4	6.3	5.8
	Cleveland ..	1.6	1.2	1.9	3.0
	Red Leaf ..	.8	3.4	6.5	9.5
	D & P L	30.4	29.1	39.3	47.8
	Missdel ..	...	...	.7	3.3
	Delfos ..	5.2	8.0	8.2	8.3
Claiborne Co.	All other	9.1	9.9	11.6	11.7
	(See Adams Co.)				
Clarke, Jasper, Jones and Wayne Cos.	Half and Half	68.6	57.3	40.3	22.3
	Cleveland ..	2.9	1.6	1.5	4.9
	Red Leaf ..	2.2	6.2	13.5	18.4
	D & P L	8.6	20.4	29.4	44.4
	Delfos ..	8.3	6.4	6.5	3.3
	All other	9.4	8.1	8.8	6.7
Clay Co.	Half & Half	52.6	41.8	32.9	22.0
	Cleveland ..	3.9	3.7	3.1	.7
	Miller ..	3.3	2.8	4.3	2.5
	D & P L	10.9	21.2	34.9	41.5
	Delfos ..	23.9	22.3	19.1	26.8
	Missdel ..	...	...	...	.3
	All other	5.4	8.2	5.7	6.2

TABLE 5

Varieties of Cotton grown in Mississippi Hill Section 1/
crop years 1928, 1929, 1930, 1931, and 1932

Variety		1928 Per ct.	1929 Per ct.	1930 Per ct.	1931 Per ct.
Copiah Co.	Half & Half.....	31.9	23.3	14.1	8.4
	Heavy Fruiter	2.2	1.8	1.0	.8
	D & P L.....	20.1	20.7	28.8	29.2
	Missdel ..	...	...	1.4	1.4
	Delfos ..	42.1	47.4	48.2	54.3
	All other	3.7	6.8	6.5	5.9
Covington Co.	Half & Half.....	81.5	80.1	74.0	45.7
	Red Cotton	.7	1.1	4.2	8.9
	D & P L.....	14.3	15.6	17.3	35.2
	Missdel ..	...	...	...	4.4
	Delfos ..	1.0	1.2	2.1	2.3
	All other	2.5	2.0	2.4	3.5
De Soto Co.	Half & Half.....	10.9	9.8	8.4	4.8
	Cleveland ..	3.3	2.3	2.2	.8
	Acala	2.0	2.9	2.4	1.0
	Stoneville ..	...	.1	.2	2.5
	D & P L	6.0	10.9	16.2	16.1
	Missdel ..	...	1.6	8.4	27.8
	Delfos ..	41.5	36.5	29.9	18.3
	All other	36.3	35.9	32.3	28.7
Forrest, George, Greene and Perry Cos.	Half & Half.....	52.1	50.1	41.8	27.3
	Rucker ..	9.9	8.4	6.0	5.9
	Cleveland ..	14.2	16.8	19.2	13.0
	Miller ..	3.1	3.2	3.4	1.7
	D & P L.....	1.7	6.1	15.5	35.2
	Delfos ..	3.9	3.0	1.9	1.5
	All other	15.1	12.4	12.2	15.4
	(See Amite Co.)				
Franklin Co.	(See Forrest Co.)				
George Co.	(See Forrest Co.)				
Greene Co.	(See Forrest Co.)				
Grenada and Yalobusha, Cos.	Half & Half.....	38.5	30.5	26.9	16.7
	Cleveland ..	5.8	4.4	5.8	2.8
	Stoneville ..	...	4.1	3.4	10.9
	D & P L.....	5.4	9.7	15.1	23.3
	Missdel ..	.2	8.2	11.9	13.2
	Delfos ..	31.6	27.3	22.5	17.3
	All other	18.5	15.8	14.4	15.7
Hinds Co.	Half & Half.....	7.1	4.7	2.7	2.0
	Cleveland ..	3.5	3.4	3.4	3.0
	D & P L.....	29.0	54.2	51.7	49.6
	Missdel ..	.8	1.2	1.8	4.8
	Delfos ..	45.7	27.0	31.9	29.9
	Webber ..	1.2	1.3	1.3	.5
	Wilds ..	...	...	.9	3.9
	All other	12.7	8.2	6.3	6.3

TABLE 5

Varieties of Cotton grown in Mississippi Hill Section ^{1/}
crop years 1928, 1929, 1930, 1931, and 1932

Variety		1928 Per ct.	1929 Per ct.	1930 Per ct.	1931 Per ct.
	Half & Half.....	69.3	69.0	60.3	47.8
	Heavy Fruiter	...	...	1.5	3.6
Ittawamba,	Cleveland ..	1.3	1.8	1.8	3.4
Prentiss, and	Miller	10.8	10.6	10.0	9.5
Tishomingo Cos.	D & P L	3.5	6.8	14.6	20.8
	Delfos ..	1.8	1.8	2.6	3.2
	All other	13.3	10.0	9.2	11.7
Jasper Co.	(See Clarke Co.)				
Jefferson Co.	(See Adams Co.)				
	Half & Half	78.1	67.2	57.4	36.5
Jefferson	D & P L	18.4	29.7	39.8	60.5
Davis Co.	All other	3.5	3.1	2.8	3.0
Jones Co.	(See Clarke Co.)				
	Half & Half	60.7	58.1	46.6	33.7
	Cleveland ..	14.0	9.2	10.7	5.4
Kemper and	Red Leaf	.4	3.5	9.0	14.5
Lauderdale Cos.	Stoneville	...	...	.9	5.6
	D & P L	3.2	7.0	12.6	22.2
	Delfos ..	8.2	6.2	7.2	6.9
	All other	13.5	16.0	13.0	11.7
Lafayette Co.	(See Benton Co.)				
	Half & Half	76.5	74.0	71.2	65.5
Lamar, Marion,	D & P L	8.0	10.7	16.5	19.2
and Wal-	Delfos ..	1.3	1.5	1.4	1.5
thall Cos.	All other	14.2	13.3	10.9	13.7
Lauderdale Co.	(See Kemper Co.)				
	Half & Half.....	68.2	54.9	40.3	23.6
	Rucker ..	3.6	2.9	2.8	4.1
Lawrence Co.	Cleveland ..	10.2	7.2	6.5	5.4
	D & P L	13.5	31.7	46.9	62.2
	All other	4.5	3.3	3.5	4.7
	Half & Half	59.4	44.3	19.9	13.1
	Cleveland ..	14.3	10.6	10.2	2.3
	Red Leaf	9.3	21.1	33.0	32.4
Leake Co.	D & P L	5.0	10.6	24.2	36.7
	Delfos ..	9.9	8.5	6.9	6.7
	Wilds ..	...	...	.4	1.7
	All other	2.1	4.9	5.4	7.1

TABLE 5

Varieties of Cotton grown in Mississippi Hill Section ^{1/}
crop years 1928, 1929, 1930, 1931, and 1932

Variety		1928 Per ct.	1929 Per ct.	1930 Per ct.	1931 Per ct.
Lee Co.	Half & Half	41.5	35.3	29.4	23.5
	Cleveland ..	5.1	3.7	2.9	2.1
	Acala ..	.3	1.2	2.8	2.2
	Miller ..	29.8	24.2	20.7	22.9
	D & P L.....	8.8	17.6	25.2	30.9
	Delfos ..	5.7	7.8	9.2	8.2
	All other ..	8.8	10.2	9.8	11.2
Lincoln Co.	Half & Half.....	41.4	40.1	36.9	42.2
	Cleveland ..	20.2	20.5	20.1	17.1
	D & P L.....	7.5	13.7	19.3	19.2
	Delfos ..	1.3	1.8	1.9	2.3
	All other ..	29.6	23.9	21.8	19.2
Lowndes Co.	Half & Half.....	24.4	31.3	28.4	20.3
	Heavy Fruiter ..	2.8	1.5	1.6	1.4
	Addison's Prolific.....	4.7	4.7	3.3	1.3
	Trice ..	9.3	1.9	2.1	1.2
	Cleveland ..	15.7	12.9	10.5	9.9
	Miller ..	12.2	9.5	8.9	12.7
	Rowden ..	.1	.8	2.0	3.1
	D & P L.....	3.3	11.6	22.0	33.1
	Delfos ..	17.0	17.3	13.4	7.5
	All other ..	10.5	8.5	7.8	9.5
Madison Co.	Half & Half	9.6	6.0	4.1	3.5
	Cleveland ..	12.6	9.4	6.2	5.0
	Red Leaf ..	1.5	1.6	2.5	2.2
	D & P L.....	32.4	41.7	41.0	43.2
	Missal ..	1.5	7.0	9.4	13.2
	Delfos ..	16.8	17.4	15.8	11.3
	Express ..	.1	.4	3.3	2.2
	Webber ..	12.0	4.5	2.4	.6
	Wilds ..	1.0	2.3	4.4	9.9
	All other ..	10.0	9.7	10.9	8.9
Marion Co.	(See Lamar Co.)				
Marshall Co.	(See Benton Co.)				
Monroe Co.	(See Chickasaw Co.)				
Montgomery Co.	(See Carroll Co.)				
Neshoba Co.	Half & Half.....	61.7	54.0	23.3	16.8
	Cleveland ..	7.8	6.7	4.4	1.7
	Red Leaf ..	14.5	9.0	17.3	26.8
	D & P L.....	3.9	17.5	39.3	43.9
	Delfos ..	9.5	10.4	12.9	6.7
	All other ..	2.6	2.4	2.8	4.1

TABLE 5

Varieties of Cotton grown in Mississippi Hill Section 1/
crop years 1928, 1929, 1930, 1931, and 1932

Variety		1928 Per ct.	1929 Per ct.	1930 Per ct.	1931 Per ct.
Newton Co.	Half & Half.....	52.3	37.1	22.6	9.8
	Cleveland ..	13.9	14.2	13.4	10.3
	Red Leaf	22.2	35.4	44.1	56.3
	D & P L.....	11.0	11.6	17.8	20.8
	All other	.6	1.7	2.1	2.8
Noxubee Co.	Half & Half.....	14.9	12.6	8.9	5.8
	Cook ..	25.5	20.5	16.5	12.0
	Cleveland ..	4.2	3.2	2.9	1.4
	Miller ..	7.8	8.0	9.1	9.5
	D & P L.....	7.9	21.4	28.1	42.0
	Missdel ..	...	...	1.5	3.7
	Delfos ..	18.4	15.9	14.8	10.7
Oktibbeha Co.	All other	21.3	18.4	18.2	14.9
	(See Choctaw Co.)				
Panola Co.	Half & Half.....	12.9	3.6	1.2	.9
	Cleveland ..	5.4	4.2	.8	.1
	Miller ..	6.9	2.8	.2	.3
	D & P L.....	35.9	42.3	53.8	48.7
	Missdel ..	.8	.6	6.7	20.9
	Delfos ..	18.0	32.0	24.5	18.1
Perry Co.	All other ..	20.1	14.5	12.8	11.0
	(See Forrest Co.)				
Pike Co.	Half & Half	47.4	46.6	43.4	40.3
	D & P L.....	21.0	20.4	17.5	16.3
	Missdel ..	1.5	1.2	.5	5.3
	Delfos ..	13.5	16.3	21.4	19.3
	All other	16.6	15.5	17.2	18.8
Pontotoc Co.	Half & Half.....	77.4	70.3	49.7	26.3
	Miller ..	16.9	16.8	15.9	12.8
	Stoneville ..	...	...	2.0	16.0
	Rowden ..	...	.3	4.5	18.8
	D & P L.....	.6	3.8	19.2	14.3
	All other	5.1	8.8	8.7	11.8
Prentiss Co.	(See Ittawamba Co.)				
	Half & Half.....	19.0	16.0	11.4	3.2
Rankin Co.	Heavy Fruiter ..	2.6	2.2	.9	.8
	Red Leaf	.8	3.1	7.3	8.0
	Acala ..	23.0	20.9	14.8	9.4
	D & P L.....	13.7	21.3	31.6	56.3
	Salesbury ..	6.1	5.0	3.1	2.5
	Sikes B.B.	2.3	2.0	1.3	.5
	Delfos ..	18.0	18.7	18.1	6.8
	All other	14.5	10.8	11.5	12.5

TABLE 5

Varieties of Cotton grown in Mississippi Hill Section ^{1/}
crop years 1928, 1929, 1930, 1931, and 1932

	Variety	1928 Per ct.	1929 Per ct.	1930 Per ct.	1931 Per ct.
Scott Co.	Half & Half	40.7	28.0	17.9	7.1
	Heavy Fruiter	2.0	4.7	1.1	1.2
	Cleveland ..	14.7	11.2	5.9	4.4
	Red Leaf	23.5	40.5	64.2	75.1
	D & P L.....	2.0	2.0	3.0	6.1
	Delfos ..	14.4	9.8	6.6	4.9
	All other	4.7	3.8	1.3	1.2
Simpson Co.	Half & Half.....	70.5	63.4	45.6	13.4
	D & P L.....	19.0	28.6	42.0	74.9
	Delfos ..	7.2	7.7	11.7	6.6
	All other	3.3	.3	.7	5.1
Smith Co.	Half & Half	72.0	59.2	45.9	22.7
	Cleveland ..	2.5	2.2	1.7	2.3
	Red Leaf	.4	2.4	10.6	12.3
	D & P L.....	14.3	23.7	37.1	57.5
	Delfos ..	8.5	7.4	2.9	2.5
	All other	2.3	5.1	1.8	2.7
Tate Co.	Half & Half.....	11.6	8.7	7.0	7.0
	Heavy Fruiter	3.4	2.8	1.1	...
	Cleveland ..	9.4	6.5	4.7	.9
	Miller ..	1.9	2.0	2.2	1.8
	Stoneville ..	...	...	...	1.3
	D & P L.....	12.9	25.7	36.1	40.8
	Lone Star	5.4	4.8	3.5	1.5
	Missdel ..	...	1.0	6.0	12.4
	Delfos ..	32.8	30.2	22.8	16.0
	All other	22.6	18.3	16.6	18.3
Tippah Co.	Half & Half	81.2	72.0	57.5	35.9
	Miller ..	4.8	7.1	6.9	6.4
	Stoneville ..	...	...	8.6	27.5
	D & P L.....	2.6	5.5	13.6	15.3
	Lone Star	...	6.4	3.2	3.3
	All other	11.4	9.0	10.2	11.6
Tishomingo Co.	(See Ittawamba Co.)				
Union Co.	Half & Half	75.2	65.3	60.1	41.5
	Miller ..	11.2	11.7	9.2	16.4
	Stoneville ..	...	...	...	11.5
	D & P L.....	.1	7.3	17.0	26.5
	Delfos ..	2.4	2.1	1.7	...
	All other	11.1	13.6	12.0	4.1
Walthall Co.	(See Lamar Co.)				
Wayne Co.	(See Clarke Co.)				
Webster Co.	(See Calhoun Co.)				
Wilkinson Co.	(See Adams Co.)				
Yalobusha Co.	(See Grenada Co.)				

^{1/} Varieties indicated include all strains except where particular strains have shown marked increase during the period of this study. So-called gin run and other miscellaneous varieties comprising less than one per cent are included in "All other".

VARYING AMOUNTS OF COTTONSEED HULLS AND SORGHUM SILAGE FOR FINISHING MATURE STEERS

BY
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Varying Amounts of Cottonseed Hulls and Sorghum Silage for Finishing Mature Steers

R. H. MEANS*

Many Mississippi farmers have found it a profitable practice to fatten mature steers and either sell them locally or ship them to a central market. Such a practice offers a market for rough feeds that otherwise have no sale value and assists in making more fertile farms as a result of the manure retained from the feeding operations. The feeds most commonly used in the fattening rations are cottonseed meal, silage, cottonseed hulls, and grass hay. From 5 to 7 pounds of cottonseed meal when combined with cottonseed hulls or silage and a small amount of hay have proved to be satisfactory rations for fattening mature steers for a feeding period of from 90 to 120 days.

The practical use of the trench silo has made it possible for farmers to feed silage at a very low cost per ton. Cottonseed hulls are available in all parts of the state and can usually be purchased and fed to an advantage. Honey sorghum, commonly referred to as Texas Seeded Ribbon Cane, due to its heavy yielding qualities, has very largely replaced other silage crops in Mississippi.

Object

The object of this experiment was to compare the feeding value of cottonseed hulls and sorghum silage when fed alone to varying mixtures of sorghum silage and cottonseed hulls for fattening mature steers, the cottonseed meal and Johnson grass hay to be fed in constant amounts.

Plan of Experiment

The plan of the experiment was to divide 32 common mature steers into 4 lots of 8 steers each and feed them the following rations:

- Lot 1: Cottonseed meal, 5 to 7 lbs.
Sorghum silage, ad libitum
Johnson grass hay, 3 lbs.
- Lot 2: Cottonseed meal, 5 to 7 lbs.
 $\frac{3}{4}$ sorghum silage, $\frac{1}{4}$ cottonseed hulls, ad libitum
Johnson grass hay, 3 lbs.
- Lot 3: Cotton seed meal, 5 to 7 lbs.
 $\frac{1}{2}$ sorghum silage, $\frac{1}{2}$ cottonseed hulls, ad libitum
Johnson grass hay, 3 lbs.
- Lot 4: Cottonseed meal, 5 to 7 lbs.
Cottonseed hulls, ad libitum
Johnson grass hay, 3 lbs.

This experiment was started in December, 1930, and three trials have been completed. The first test was for a period of 106 days, the second 99 days, and the third 120 days. The steers were weighed individually on three consecutive days at the beginning and at the end of each test, and the averages of the three weights taken at the beginning and at the end of each test were used as average initial and average final weights. In order to check the gains made, individual weights were taken every 14 days during the progress of the experiment. On the second weighing day at the beginning of each test the steers were divided as

*The author is indebted to Mr. Henry H. Leveck for suggestions and assistance in conducting these experiments.

nearly as possible with reference to quality, weight, and condition into 4 equal lots and started on the experimental rations. They were fed daily, at 7 A. M. and 5 P. M., on all feeds except hay, which was all fed at the evening feed. The silage, hulls, and combinations of silage and hulls were fed ad libitum and the hay was limited to 3 pounds per steer. Two pounds of cottonseed meal per steer were fed for the first 4 days. The meal was increased 1 pound each 4 days until 6 pounds were being fed. This amount was fed during the first 60 days of the test. Seven pounds were fed during the next 30 days and 8 pounds were fed during the remainder of the test. The cottonseed meal was thoroughly mixed with the silage and hulls and silage and hulls mixture. Adjustments were made on a dry weight basis in mixing the cottonseed hulls and sorghum silage, 3 pounds of silage being allowed for each pound of cottonseed hulls fed. In Lot 2 the ratio was 1 pound of cottonseed hulls to 9 pounds silage and in Lot 3 the ratio was 1 pound of cottonseed hulls to 3 pounds silage.

Fresh water was supplied to each lot in concrete troughs and block salt was available at all times.

The salt requirement per steer per day for each lot is shown in Table 2.

Cattle Used

The steers used in the three trials were of Jersey breeding, commonly termed Yellow Hammers, and were 2 years old or older. All cattle used were dehorned. Their average initial weights were 866 pounds in 1930, 992 pounds in 1931, and 767 pounds in 1932.

All the steers went on feed with good appetites and in neither test were there any indications of scouring. During the 1932-33 test one steer in Lot 3 went off feed and failed to gain in weight about 60 days after the test had begun and was removed from the experiment. All steers in the 1932-33 trial, for some unknown reason, made small daily gains.

Management Previous to Feeding Test

Each year the steers were purchased from 4 to 6 weeks before the feeding test started and were run together on a Bermuda and Paspalum pasture. About 10 days before the steers were to be weighed, they were brought to the barn and fed one pound of cottonseed meal per steer and all the silage they would clean up. Each group was raised only a few miles from State College and had been on pasture together during the grazing season previous to experimental test. For identification each steer was branded on the left rump at the time of purchase.

Management During Feeding Test

The four lots of cattle received as nearly the same treatment as was possible during the experimental feeding period. Each lot was fed under a shed 30 feet long and 16 feet wide. These sheds opened into lots approximately 1/7 acre in size. The lots became very muddy during rainy weather, but the stalls were bedded with oat straw as often as it was necessary to keep them dry. All the feeding was done by student labor under the supervision of the Animal Husbandry Department of the Experiment Station.

Feeds

The cottonseed meal and cottonseed hulls used in this test were purchased on sealed bids and the meal used in each trial graded prime. The cottonseed hulls were of good quality and were free from foreign material. The sorghum silage and Johnson grass hay used were grown on the Experiment Station farm. The silage in all cases was made from sorghum that had well matured seed and was of good quality having a pleasant odor and a bright color. The Johnson grass hay would have graded barely No. 1.

Chemical analyses of the cottonseed meal, sorghum silage, and cottonseed hulls were made by the Chemistry Department of the Mississippi Experiment Station

and are reported in Table 1. From 1 to 3 samples of each feed were taken during each trial.

Marketing

Each group of steers was sold on the St. Louis market where shipping, selling, and slaughtering information was secured. The cattle were driven to the loading pens early in the afternoon and after they were given about an hour to drink water they were loaded. They arrived in East St. Louis about 7 P. M. the following day. The following morning they were divided into the 4 lots and sold in this manner. The shipping, selling, and slaughtering data for the three trials are reported in Tables 3, 4, 5, and 6.

Table 1—Average Per Cent Composition of Cottonseed Meal, Cottonseed Hulls, and Sorghum Silage*

Feed	Year	Moisture	Ash	Crude protein	Crude fat	Crude fiber	Nitrogen free extract
C. S. Meal	1930-31	6.66	5.73	41.96	5.56	11.30	28.78
C. S. Meal	1931-32	8.59	6.54	40.00	8.00	6.83	30.04
C. S. Meal	1932-33	6.73	6.23	41.60	7.22	8.63	29.56
C. S. Hulls	1930-31	13.40	2.10	3.58	.33	45.96	34.61
C. S. Hulls	1931-32	12.26	2.44	3.38	.48	46.34	35.10
C. S. Hulls	1932-33	13.47	1.87	2.67	.44	47.97	33.56
S. Silage	1930-31	76.50	1.06	1.47	.57	6.24	14.15
S. Silage	1931-32	74.26	1.42	1.63	.66	5.80	16.23
S. Silage	1932-33	78.06	1.12	1.26	.68	7.97	10.89

*Chemical analyses of the above feeds were made by the Chemistry Department of Mississippi Experiment Station.

Table 2—Average Daily Salt Consumption per Steer per Lot

Lot 1	Lot 2	Lot 3	Lot 4
.81 oz.	.91 oz.	1.00 oz.	.42 oz.

No reference is made to profit or loss in Tables 3, 4, 5, or 6. The price of feeder cattle and feeds varies from year to year, making it necessary for one to determine the price at which steers fed various rations must sell in order for the feeding operation to be profitable. This necessary selling price can be arrived at by dividing the total cost of steers at the end of the feeding period by the final weight of the finished steers.

Example—The total cost of a steer in Lot 1 for the year 1931 was: \$41.79, cost of feeder steers at \$4.82 per hundred, plus \$20.88, cost of feed per steer with cottonseed meal at \$20 per ton, sorghum silage at \$2.80 per ton, and Johnson grass hay at \$12.00 per ton—a total cost of \$62.67 at the feed lot. This divided by 1,064 pounds, the final weight of steer, gives \$.0588 per pound or \$5.88 necessary selling price per cwt to break even on steers fed the ration in Lot 1.

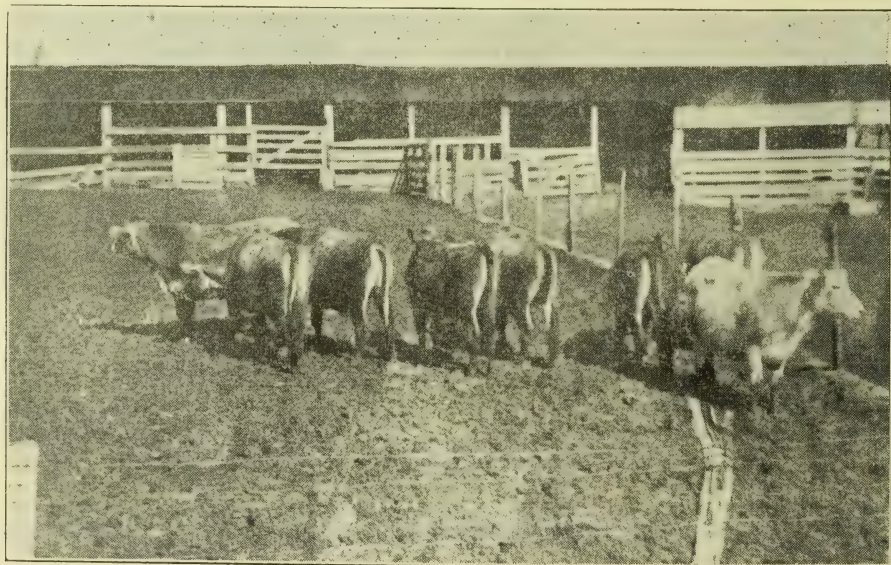
Table 3—Varying Amounts of Cottonseed Hulls and Sorghum Silage for Finishing Mature Steers

Date of test—December 11, 1930, to March 26, 1931.

Length of test—106 days.

Breeding of cattle—Yellow Hammer.

	Lot 1 C. S. Meal, Sorghum silage, J. G. Hay	Lot 2 C. S. Meal, $\frac{1}{4}$ C. S. Hulls, $\frac{3}{4}$ Sorghum silage J. G. Hay	Lot 3 C. S. Meal, $\frac{1}{2}$ C. S. Hulls, $\frac{1}{2}$ Sorghum silage J. G. Hay	Lot 4 C. S. Meal, C. S. Hulls, J. G. Hay
No steers per lot	8	8	8	8
Average initial weight .....(lbs.)	866.87	867.71	863.54	869.17
Average final weight .....(lbs.)	1064.37	1075.00	1062.71	1052.71
Average daily gain .....(lbs.)	1.863	1.955	1.879	1.731
Average daily ration:				
Cottonseed meal .....(lbs.)	5.67	5.67	5.67	5.67
Cottonseed hulls .....(lbs.)		6.13	13.55	30.05
Sorghum silage .....(lbs.)	70.92	55.10	40.03	
Johnson grass hay .....(lbs.)	3	3	3	3
Feed required per cwt. gain:				
Cottonseed meal .....(lbs.)	304.83	290.02	301.76	327.46
Cottonseed hulls .....(lbs.)		313.55	710.49	1735.99
Sorghum silage .....(lbs.)	3806.79	2818.37	2130.40	
Johnson grass hay .....(lbs.)	161.86	153.45	159.66	173.31
Shrink per cent	8.04	7.67	7.54	7.85
Dressing per cent (market wt.)....	57.12	56.15	56.22	55.94
Shipping and selling cost per steer	\$ 5.93	5.99	5.94	5.89
Selling price per cwt.(\$)	6.85	7.00	7.15	7.00



Lot 1, 1932-33 test, steers fed cottonseed meal, sorghum silage, and Johnson grass hay.

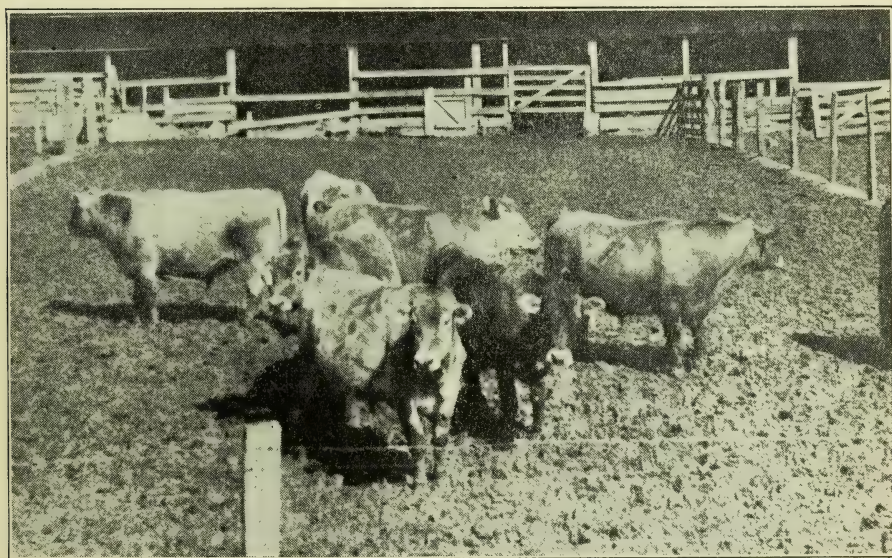
Table 4—Varying Amounts of Cottonseed Hulls and Sorghum Silage for Finishing Mature Steers

Date of test—October 22, 1931, to January 29, 1932.

Length of test—99 days.

Breeding of cattle—Yellow Hammer.

	Lot 1 C. S. Meal, Sorghum silage J. G. Hay	Lot 2 C. S. Meal, $\frac{1}{4}$ C. S. Hulls, $\frac{3}{4}$ Sorghum silage J. G. Hay	Lot 3 C. S. Meal, $\frac{1}{2}$ C. S. Hulls, $\frac{1}{2}$ Sorghum silage J. G. Hay	Lot 4 C. S. Meal, C. S. Hulls, J. G. Hay
No. steers per lot	8	8	8	8
Average initial weight .....(lbs.)	995.6	992.3	992.7	987.3
Average final weight .....(lbs.)	1150.4	1150.2	1155.8	1125.8
Average daily gain .....(lbs.)	1.563	1.595	1.647	1.40
Average daily ration:				
Cottonseed meal .....(lbs.)	5.79	5.79	5.79	5.79
Cottonseed hulls .....(lbs.)		8.26	17.51	38.4
Sorghum silage .....(lbs.)	77.34	74.38	52.54	
Johnson grass hay .....(lbs.)	3	3	3	3
Feed required per cwt. gain:				
Cottonseed meal .....(lbs.)	370.4	363.0	351.5	413.5
Cottonseed hulls .....(lbs.)		517.8	1063.0	2742.8
Sorghum silage .....(lbs.)	4948.0	4663.3	3190.0	
Johnson grass hay .....(lbs.)	191.9	188.0	182.1	214.2
Shrink per cent	6.98	6.43	6.36	5.62
Dressing per cent (market wt.)	58.23	58.48	59.11	58.73
Shipping and selling cost per steer (\$)	6.27	6.30	6.32	6.22
Selling price per cwt. (\$)	4.35	4.35	4.45	4.25



Lot 2, 1932-33 test, steers fed cottonseed meal, $\frac{1}{4}$ cottonseed hulls, $\frac{3}{4}$ sorghum silage, and Johnson grass hay.

Table 5—Varying Amounts of Cottonseed Hulls and Sorghum Silage for Finishing Mature Steers

Date of test—October 26, 1932, to February 22, 1933.

Length of test—120 days.

Breeding of Cattle—Yellow Hammer.

	Lot 1 C. S. Meal Sorghum silage J. G. Hay	Lot 2 C. S. Meal $\frac{1}{4}$ C. S. Hulls, $\frac{3}{4}$ Sorghum silage J. G. Hay	Lot 3 C. S. Meal $\frac{1}{2}$ C. S. Hulls, $\frac{1}{2}$ Sorghum silage J. G. Hay	Lot 4 C. S. Meal C. S. Hulls, J. G. Hay
No. steers per lot	8	7	8	8
Average initial weight .....(lbs.)	761.0	777.1	762.0	769.5
Average final weight .....(lbs.)	895.6	949.8	935.4	944.6
Average daily gain .....(lbs.)	1.12	1.43	1.44	1.45
Average daily ration:				
Cottonseed meal .....(lbs.)	6.35	6.35	6.35	6.35
Cottonseed hulls .....(lbs.)		4.96	11.6	24.85
Sorghum silage .....(lbs.)	53.0	44.66	34.8	
Johnson grass hay .....(lbs.)	3.0	3.0	3.0	3.0
Feed required per cwt. gain:				
Cottonseed meal .....(lbs.)	566.9	442.0	440.2	436.0
Cottonseed hulls .....(lbs.)		345.0	803.7	1704.2
Sorghum silage .....(lbs.)	4725.0	3105.0	2411.1	
Johnson grass hay .....(lbs.)	267.5	208.5	207.7	205.7
Shrink per cent	7.0	6.0	6.7	7.5
Dressing per cent (market wt.)	55.0	54.0	56.4	57.5
Shipping and selling cost per steer (\$)	4.83	5.18	5.06	5.07
Selling price per cwt. (\$)	3.25	3.50	3.50	3.60

Lot 3, 1932-33 test, steers fed cottonseed meal, $\frac{1}{2}$ cottonseed hulls, $\frac{1}{2}$ sorghum silage, and Johnson grass hay.

Table 6—Varying Amounts of Cottonseed Hulls and Sorghum Silage for Finishing Mature Steers

Summary of 3 Trials

Average length of test—108 days

Total number of steers per lot—24*

	Lot 1 C. S. Meal, Sorghum silage, J. G. Hay	Lot 2 C. S. Meal, $\frac{1}{4}$ C. S. Hulls, $\frac{3}{4}$ Sorghum silage, J. G. Hay	Lot 3 C. S. Meal, $\frac{1}{2}$ C. S. Hulls $\frac{1}{2}$ Sorghum silage, J. G. Hay	Lot 4 C. S. Meal, C. S. Hulls, J. G. Hay
Average initial weight	(lbs.) 874.4	879.0	872.7	875.3
Average final weight	(lbs.) 1036.7	1058.3	1051.3	1041.0
Average gain per steer	(lbs.) 162.3	179.3	178.6	165.7
Average daily gain	(lbs.) 1.50	1.65	1.65	1.53
Feed required per cwt. gain:				
Cottonseed meal	(lbs.) 414.0	365.0	364.5	392.3
Cottonseed hulls	(lbs.)	392.1	859.0	2061.0
Sorghum silage	(lbs.) 4493.2	3528.8	2577.2	
Johnson grass hay	(lbs.) 207.1	183.3	183.1	197.7
Shrink per cent	7.34	6.70	6.93	6.99
Dressing per cent (market wt.)	56.78	56.21	57.24	57.39
Shipping and selling cost per steer (\$)	5.68	5.82	5.77	5.73
Selling price per cwt. (\$)	4.82	4.95	5.03	4.95

*In the 1932-33 trial, one steer was removed from lot 2.



Lot 4, 1932-33 test, steers fed cottonseed meal, cottonseed hulls, and Johnson grass hay.

General Summary

1. When cottonseed hulls and sorghum silage were fed in the ratio of 1 pound cottonseed hulls to 3 pounds sorghum silage (dry weight basis), 392.1 pounds of hulls replaced 49 pounds of cottonseed meal, 964.4 pounds sorghum silage, and 23.8 pounds Johnson grass hay in producing 100 pounds gain; or, 1000 pounds of cottonseed hulls replaces 125 pounds cottonseed meal, 2459.6 pounds silage, and 60.7 pounds Johnson grass hay.

2. When equal parts of cottonseed hulls and sorghum silage (dry weight basis) were fed, 859 pounds of cottonseed hulls replaced 49.5 pounds of cottonseed meal, 1916 pounds sorghum silage, and 24 pounds Johnson grass hay in producing 100 pounds gain; or, 1000 pounds cottonseed hulls will replace 57.6 pounds meal, 2230.5 pounds silage, and 27.9 pounds Johnson grass hay.

3. When cottonseed hulls were fed with no silage, 2061 pounds hulls replaced 21.7 pounds cottonseed meal, 4493.2 pounds sorghum silage, and 9.4 pounds Johnson grass hay in producing 100 pounds gain; or, 1000 pounds cottonseed hulls will replace 10.5 pounds cottonseed meal, 2180.1 pounds silage, and 4.6 pounds Johnson grass hay.

The steers receiving the combinations of cottonseed hulls and sorghum silage made .15 pound greater daily gain than the silage fed group and .12 pound greater daily gain than the group fed cottonseed hulls.

The average selling prices per 100 pounds for the three trials were as follows: Lot 1, \$4.82; Lot 2, \$4.95; Lot 3, \$5.03; and Lot 4, \$4.95.



REPORT FROM

Holly Springs Branch Experiment Station For 1933

By

C. T. AMES

Mississippi Agricultural Experiment Station
State College, Mississippi
J. R. RICKS, Director

ANNUAL REPORT OF THE HOLLY SPRINGS BRANCH EXPERIMENT STATION FOR 1933

By
C. T. AMES

The work of the station was continued in 1933, as far as possible, on problems, the solution of which will improve agriculture in the adjoining area. Enforced economies called for retrenchment in some phases of the work, but many projects were continued and the results from some of them are reported in this publication. Reports will be made on several other tests when they have been continued long enough to be definitely conclusive.

TABLE 1—COTTON VARIETIES—VALLEY LAND—HOLLY SPRINGS—1929-33

Variety	Per Acre		Rank in Value	Lint Data	
	Pounds Lint	Total Value		Percentage	Length
Stoneville 3	637.8	82.14	1	35.6	1
Missdel 4	610.5	79.07	2	33.0	1 3/32
Stoneville 2	602.7	77.71	3	33.2	1 1/32
Half & Half	586.3	63.81	11	40.4	25/32
Cleveland 54	558.4	72.64	4	33.4	15/16
Lone Star 561	524.7	67.95	8	34.5	1
Missdel 1	523.8	70.43	6	32.2	1 3/32
Miller 589	518.9	70.98	5	34.3	31/32
Rowden	513.8	68.02	7	33.2	31/32
Wilson Type	509.7	63.27	12	32.1	7/8
Acala	493.6	65.33	9	32.9	1
Cleveland 884	475.0	57.99	14	33.2	1
Lightning Express	465.8	65.17	10	31.0	1 3/32
Deltatype Webber	424.2	62.76	13	30.8	1 5/32

The valley variety tests were planted on improved brown loam valley land and fertilized with 400-600 lbs. 4-8-4 fertilizer to the acre. Planting date 1933 was May 10.

TABLE 2—COTTON VARIETIES—VALLEY LAND—HOLLY SPRINGS—1933

Variety	Per Acre		Rank in Value	Lint Data		Bolls Per Lb.
	Pounds Lint	Total Value		Percentage	Length	
D. & P. L. 11	663.1	69.85	4	39.8	1	70
D. & P. L. 10	661.0	70.07	3	35.1	31/32	70
Stoneville 2	656.4	70.76	2	34.6	1	66
Rowden 5056	655.3	67.34	9	35.6	29/32	55
Stoneville 5	653.6	68.46	7	37.7	31/32	72
Stoneville 3	639.7	67.15	10	37.2	31/32	69
Acala 1114	634.7	66.93	11	36.2	31/32	64
Stoneville 2A	629.9	67.87	8	34.7	1	66
Delfos 719	625.1	68.89	5	35.7	1 1/32	59
Delfos 531	620.0	71.03	1	34.1	1 3/32	73
Cleveland 54	619.1	64.15	13	34.0	29/32	65
Half & Half	613.0	54.57	23	41.9	3/4	64
Missdel 4	610.6	68.49	6	35.8	1 1/16	72
Stoneville 4	604.2	65.43	12	33.7	1	56
Acala 4067	575.9	60.87	16	35.7	31/32	57
Lone Star 561	572.2	60.46	17	35.8	31/32	58
Rowden 2088	558.3	59.72	18	33.4	31/32	58
Cleveland 884	548.8	58.58	20	33.8	31/32	62
Missdel 1	547.0	62.19	15	33.0	1 1/16	62
Miller 610	544.8	56.64	22	35.2	15/16	54
Missdel 3	522.7	62.73	14	32.5	1 1/8	64
Wilson Type	520.8	52.54	25	32.7	27/32	67
Lightning Express	517.5	59.29	19	31.6	1 1/16	77
Miller 589	499.4	52.24	26	34.0	15/16	56
Deltatype Webber	486.6	58.54	21	32.0	1 1/8	58
Farm Relief	481.8	53.38	24	34.6	1 1/32	58

TABLE 3—COTTON VARIETIES—HILL LAND—HOLLY SPRINGS—1929-33

Variety	Per Acre		Rank in Value	Lint Data	
	Pounds Lint	Total Value		Percent-age	Length
Stoneville 3	524.2	60.98	1	38.5	31/32
Half & Half	516.6	49.24	9	44.3	25/32
Missdel 4	479.8	56.59	2	35.9	1 1/16
Stoneville 2	470.3	55.06	3	36.2	1
Cleveland 884	451.8	49.66	7	36.0	31/32
Cleveland 54	435.6	49.21	10	36.1	29/32
Lone Star 561	430.0	50.06	5	37.3	31/32
Wilson Type	428.6	46.46	14	35.0	27/32
Missdel 1	417.8	50.85	4	35.0	1 1/16
Acala	396.6	47.73	12	35.4	31/32
Lightning Express	393.9	49.66	6	33.5	1 1/16
Rowden	391.2	48.65	11	35.7	15/16
Miller 589	390.0	49.25	8	37.3	15/16
Deltatype Webber	356.0	46.50	13	32.9	1 1/8

The soil used for the hill tests was brown loam table land which had been improved by legume rotations. Planting date 1933 was May 10. The tests were usually fertilized with 400-600 lbs. 4-8-4 fertilizer to the acre.

TABLE 4—COTTON VARIETIES—HILL LAND—HOLLY SPRINGS—1933

Variety	Per Acre		Rank in Value	Lint Data		
	Pounds Lint	Total Value		Percent-age	Length	Bolls Per Lb.
Half & Half	519.6	45.82	10	44.3	3/4	72
D. & P. L. 10	491.2	51.56	1	37.2	31/32	85
Delfos 719	476.9	50.86	2	36.8	1	69
Stoneville 3	471.7	49.84	3	38.0	31/32	86
Acala 4067	463.2	47.54	6	37.9	15/16	74
Acala 1114	455.6	46.73	8	38.1	15/16	71
Stoneville 2A	446.8	47.74	5	36.4	1	77
Stoneville 4	446.6	48.11	4	34.7	1	65
Miller 589	415.0	45.00	13	36.2	29/32	65
Stoneville 5	439.6	45.79	11	39.0	31/32	86
D. & P. L. 11	431.2	44.50	10	41.5	31/32	84
Stoneville 2	426.7	45.68	12	36.0	1	84
Cleveland 54	423.8	43.53	18	35.7	29/32	78
Missdel 1	421.6	46.76	7	34.4	1 1/32	72
Rowden 2088	420.8	44.53	15	35.5	31/32	61
Cleveland 884	418.1	44.20	17	35.7	31/32	80
Missdel 4	408.1	44.80	14	36.6	1 1/32	88
Delfos 531	407.7	45.06	9	34.7	1 1/16	84
Lone Star 561	401.7	42.23	19	36.9	31/32	70
Rowden 5058	398.3	40.71	22	36.7	29/32	66
Miller 610	397.6	40.98	21	37.0	15/16	70
Wilson Type	396.1	39.28	25	35.8	27/32	83
Farm Relief	392.7	41.77	20	37.4	1	68
Missdel 3	358.2	40.44	23	34.4	1 3/32	74
Lightning Express	357.4	39.77	24	33.7	1 1/32	85
Deltatype Webber	300.2	34.57	26	33.0	1 3/32	69

Cotton spacing tests have been conducted every year when possible because of the widespread interest in this subject. Results from eight years work are presented in Table 5. No data are available for 1931 and 1932. The hill tests were planted on improved brown loam table soil and the valley tests were planted on improved brown loam valley soil.

In preparing for these tests cotton on all plots was planted at a heavy rate per acre. At thinning time certain plots were left unthinned. An attempt was made to thin one group of plots to three plants per foot, another group to two plants per foot, a third group to one plant per foot, a fourth group to one plant to each

eighteen inches, and a fifth group to one plant to each two feet. Since in work of this kind it is not possible to obtain any desired spacing exactly, the number of plants actually present at harvest was counted. From these counts the number per foot was computed.

From a study of these spacing results year by year it appears that cotton on hill soils should be spaced two to four plants to the foot. On valley soils one to three plants to the foot should give highest yields. In attempting to decide the spacing to use on any given soil several things should be borne in mind. Cotton plants must have sunlight if they are to fruit well. This should be watched on fertile moist bottom soils. On the other hand closer spacing will be best on soils where the plants do not grow tall and on nearly any soil when the fruiting season is short. Above all, strive for a regular distribution of plants. Unoccupied spaces on the row do not produce cotton.

TABLE 5—EIGHT YEARS OF COTTON SPACING TESTS
Plants Reported as Number Per Foot and Seed Cotton as Pounds per Acre

1924	1925		1926		1927		1928		1929		1930		1931		Average	
	Yield	Plants	Yield	Plants	Yield	Plants	Yield	Plants	Yield	Plants	Yield	Plants	Yield	Plants	Yield	Yield
Hill Tests																
2.85	1077.1	5.07	1707.1	4.60	1677.3	4.02	1029.6	3.12	1090.0	4.50	1140.7	2.59	729.2	4.10	1525.1	3.86
2.33	1111.8	2.57	1492.0	2.87	1600.3	2.43	1020.6	2.20	983.1	2.60	1221.0	1.53	738.4	2.07	1504.9	2.33
1.55	1089.6	1.98	1569.1	1.90	1537.7	1.75	915.5	1.53	1044.3	2.20	1196.8	1.43	754.3	1.49	1655.9	1.73
1.17	1088.6	1.24	1537.4	1.15	1515.0	1.20	904.7	.89	1101.6	1.00	1095.6	.88	733.8	.84	1497.0	1.05
.86	1084.0	.76	1405.9	.89	1487.5	.70	823.5	.60	1079.6	.82	1293.0	.65	748.7	.73	1647.1	.75
.72	1114.0	.59	1106.5	.59	1470.8	.63	764.0	.53	1061.9	.65	1294.0	.57	830.3	.60	1470.4	.61
Valley Tests																
3.31	257.5	5.82	1896	4.59	1499.2	5.03	1588.7	3.12	995.3	4.10	1756.8	3.30	1432.2	6.27	1484	4.44
2.04	1657	3.41	1890	3.01	1419.6	2.44	1781.3	1.93	1043.2	2.10	1864.8	1.90	1871.5	2.65	1749	2.44
1.77	1604	2.35	1722	2.21	1550.7	1.70	1686.8	1.40	1005.6	1.60	2071.6	1.42	1922.6	1.52	1838	1.75
1.12	1514	1.62	1650	1.24	1606.9	.89	1676.5	.81	1023.4	.89	2018.5	.91	1939.1	.96	2035	1.06
.85	1516	.82	1524	.97	1243.0	.66	1548.8	.61	1093.0	.85	2223.0	.71	2025.4	.59	2134	.77
.75	1348	.67	1392	.50	1219.5	.57	1648.5	.57	1012.2	.60	2234.0	.47	1915.8	.60	2133	.59

TABLE 6—CORN VARIETIES—HOLLY SPRINGS

	Bushels Per Acre				Average
	1929	1931	1932	1933	
Hastings Pro.	82.4	84.2	30.9	29.9	56.9
Paymaster	71.7	62.1	41.7	32.1	51.9
Cocke's Pro., Sta.	70.0	67.5	39.0	29.9	51.6
College 47	61.2	60.1	44.6	30.4	49.1
Mosby, Delta	63.4	63.7	36.9	30.6	48.7
Mosby, Sta.	60.8	62.9	34.8	32.1	47.7
College G4	56.0	67.7	35.3	29.3	47.1
College Y4	64.4	59.9	35.6	26.9	46.7
Laguna	53.2	48.7	44.6	30.8	44.3
Golden Dent, R. H.	37.8	44.8	34.0	28.6	36.3
Yellow Dent, Ferg.	38.6	27.6	30.6	29.8	31.7
Mexican June	52.0	44.7	41.4	.....	.....
Jellicorse .....	.....	65.8	31.6	35.7	.....
Jarvis .....	.....	43.4	33.8	28.9	.....
Mosby, Woodruff .....	.....	.....	20.3	28.1	.....
Marchetti Yellow .....	.....	.....	.....	27.6	.....
Cocke's Pro., Wood .....	.....	48.8	32.4	25.4	.....
Golden Pro., Wood .....	.....	.....	34.3	25.1	.....

The 1933 test was planted on improved valley soil on May 10. 200 pounds 4-8-8 fertilizer to the acre was previously applied. A dry period at the critical stage caused the yields to be much lower than usual. Plantings at other dates on other parts of the farm yielded much better.

Planting in other years was usually done in May or early June after the turning of a legume. When a legume was not turned the crop was fertilized much the same as in 1933.

TABLE 7—COTTON FERTILIZER ANALYSIS TEST

Analysis	1933				8-Year Average	
	Pounds of Seed Cotton per Acre		Dollars per Acre		Seed Cotton	Dollars Per Acre
	Yield	Increase Over No Fertilizer	Value of Increase at 3.5c lb.	Net Gain	Increase Over No Fertilizer	Net Gain Based On 1933 Prices
No Fertilizer	894.4	.....	.....	.....	.....	.....
4-8-8	1991.5	1096.1	38.36	31.81	762	20.13
4-8-6	1930.2	1033.8	36.18	30.16	669	17.39
4-8-4	1650.3	752.9	26.35	20.85	612	15.92
No fertilizer	898.4	.....	.....	.....	.....	.....
4-8-2	1283.7	393.3	13.76	8.79	430	10.06
4-8-0	845.1	-37.3	-1.30	-5.74	264	4.78
8-8-4	1535.6	661.1	23.13	15.23	579	12.38
No fertilizer	866.5	.....	.....	.....	.....	.....
6-8-4	1622.3	741.9	25.96	19.26	616	14.85
4-6-4	1548.9	654.5	22.90	17.91	555	14.42
4-4-4	1642.3	733.9	25.68	21.20	584	15.95
No fertilizer	922.4	.....	.....	.....	.....	.....
Avg. yield, no fertilizer	985.4	.....	.....	.....	860	.....

This test has been conducted on the same plots for nine years on Brown Loam valley land.

The table for 1933: The yields of the various treatments, the increase in yields due to the various treatments, the value of this increase at 3.5c per pound for seed cotton, and the gain in dollars per acre over the cost of fertilizer.

The table also shows the nine year average increase per acre and the gain in dollars per acre of this increase based on 1933 costs and values.

Prices used: Seed cotton, 3.5c per pound; 16% nitrate of soda, \$32.00 per ton; 20% superphosphate, \$17.00 per ton; 50% muriate of potash, \$44.00 per ton; 4-8-4, \$18.33 per ton.

All applications 600 pounds per acre.

Cotton Fertilizer Test. Rates Per Acre—This test was conducted on thin loam land.

Table No. 8 shows the results for 1933. The cotton was planted late, May 31. There was some boll weevil infestation.

Fertilizer used: 6-12-6 at varying rates per acre.

TABLE 8

Fertilizer Pounds per Acre	Pounds seed Cotton per acre	Dollars per Acre		
			Value of Increase at 3.5c per lb.	Gain Over Cost of Fertilizer
6-12-6*	Yield	Increase		
No fert.	620.4			
200 lbs.	949.5	329.1	11.52	8.77
300 lbs.	1083.4	463.0	16.21	12.09
400 lbs.	1137.9	517.5	18.11	12.61
500 lbs.	1305.1	684.7	23.96	17.09
600 lbs.	1384.9	764.5	26.76	18.52

Phosphorus Sources Test—Table 9 shows the beneficial effect of phosphorus on thin loam table land of North Mississippi.

TABLE 9

Fertilizer Used	Yield seed cotton	Increase over No phosphorus
600 lbs. 6-0-6	762	.....
600 lbs. 6-9-6, phosphorus from superphosphate	1126	364
600 lbs. 6-10-6, phosphorus from basic slag	942	180
600 lbs. 6-0-6 plus 350 lbs. rock phosphate	977	215
600 lbs. 6-0-6 plus 350 lbs. colloidal phosphate	914	152
600 lbs. 6-12-6, phosphorus from superphosphate	1295	533
No fertilizer	609	.....

Lint Test—Table No. 10 shows the yield of seed cotton on limed and unlimed plots following three years of soybeans.

Alternate plots were limed in 1929. Soybeans were grown without fertilizer on all plots for three years.

In 1933 cotton was grown on all plots and fertilized with 250 pounds 4-8-6 per acre.

TABLE 10

Treatment 1933	Yield, pounds seed cotton	Increase
Aug. 14 unlimed plots	783	.....
Aug. 14 limed plots	998	215

This increase is attributed to the indirect effect. That is, the increase is to a large extent due to the beneficial effect of lime on the soybeans and the subsequent effect of the soybeans on the cotton.

A COMPILATION OF
EXPERIMENTAL
AND OTHER
DATA
ON
WINTER LEGUMES



Photo by Courtesy Alabama Agricultural Experiment Station, Auburn, Alabama.

COMPILED BY
MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
IN COOPERATION WITH
MISSISSIPPI STATE VOCATIONAL BOARD

J. R. RICKS, Director,
Mississippi Agricultural Experiment Station
State College, Mississippi

State College, Miss.,
August 7, 1934.

To the Vocational Agriculture Teachers and
County Agents of Mississippi:

This is the first of a series of bulletins to be issued in cooperation with the State Vocational Board for your special use in teaching farmers and farm boys. We have begun this work in response to the many requests that you have made to the station for this specialized type of information.

We hope that this may reach you in time to be of maximum benefit to you. We hope that it serves your purpose properly. If, at any time, you have any suggestions for improvement, we hope that you will not fail to report such suggestions to us. We are here to serve the people of the state and feel that this is only one way of improving our service.

Very truly yours,

J. R. RICKS, Director
Mississippi Agricultural Experiment Station.

I. DETERMINING WHETHER OR NOT IT WILL PAY TO GROW WINTER LEGUMES.

A. COST.

What is the cost of growing winter legumes? How does the cost compare with that of commercial fertilizers?

Table 1 shows the results of a study made by the Division of Farm Management and Costs, Bureau of Agricultural Economics on the cost of growing winter legumes.

TABLE 1. EXTRA COST PER ACRE TO PRODUCE CORN AND COTTON AFTER WINTER LEGUMES†
COST FOR STARTING LEGUMES AT HIGH PRICES§

Item	For Corn			For Cotton		
	Cash cost	Non-cash cost	Total cost	Cash cost	Non-cash cost	Total cost
Seed and inoculation	\$ 2.96	\$	\$ 2.96	\$ 3.12	\$	\$ 3.12
Man labor .....	.....	0.67	.67	.....	0.60	.60
Horse labor .....	.....	.80	.80	.....	.67	.67
Implement and machinery charge .....	.....	.27	.27	.....	.18	.18
Fertilizer	.81	.....	.81	.50	.....	.50
Total	3.77	1.74	5.51	3.62	1.45	5.07

EXTRA COST ON SUBSEQUENT CROP

Man labor gathering extra yield	.35	.35	.45	2.50*	2.95
Ginning and wrapping extra yield .....	.....	.....	1.04	.....	1.04
Horse labor gathering extra corn	.35	.35	.....	.....	.....
Wagon charge gathering extra corn	.05	.05	.....	.....	.....
Hauling extra cotton to gin .....	.....	.....	.....	.60	.60
Extra work plowing down legume	.25	.25	.....	.30	.30
Total	1.00	1.00	1.49	3.40	4.89
Grand total	3.77	2.74	6.51	5.11	9.96

Credit for fertilizer	.90	.....	.90	1.31	1.31
Credit for labor applying fertilizer .....	.....	.07	.07	.....	.04
Total Credit	.90	.07	.97	1.31	1.35
Net cost at high prices**	2.87	2.67	5.54	3.80	8.61
Net cost at low prices§§	1.88	1.48	3.36	2.39	4.91

†4.145 acres of corn and 1.877 acres of cotton were studied.

§Figures in last line of table show net cost at low prices.

*This amount is about 85 per cent of the total of \$2.95 on the assumption that 85 percent of the cotton was picked by the families and only 15 percent was picked by hired labor.

**Prices used in calculating costs: High prices: Man and horse labor, 15 cents an hour each; legume seed, \$3 an acre; ginning and wrapping \$5 a bale; fertilizers, prices of 1927, 1928, 1929.

§§Low prices: Man and horse labor, 7½ cents an hour each; legume seed \$2 an acre; ginning and wrapping, \$3.50 a bale; fertilizers, 85 percent of prices of 1927, 1928, 1929.

Reference: Table 7, page 12, Technical Bulletin 367, U. S. D. A. Washington, D. C.
Data compiled from a survey of 500 fields of winter legumes grown by 300 farmers in Alabama, Georgia, and South Carolina. Of the usable estimates of

acreage, 125 were made in 1929 for crops of cotton and corn grown after winter legumes in 1928 and earlier, and 375 were made in 1930 for crops harvested in 1929 and earlier. In addition, 31 estimates for corn crops and 14 estimates for cotton crops were obtained for a period of 3 to 5 years.

There were 264 estimates for corn and cotton after vetch, 193 after Austrian Winter Peas, 32 after crimson clover and 11 after Southern bur clover. The size of the vetch fields and winter pea fields averaged, in each case, a little more than 12 acres. The crimson-clover and bur-clover fields averaged approximately 7 acres each.

Both large and small farms were visited and estimates were obtained from areas as small as one acre and as large as 100 acres. Some farmers grew both vetch and winter peas and some had two or more tracts of the same legume growing under different conditions. The acreage frequency is as follows:

FOOTNOTE TABLE 1. CORN AFTER WINTER LEGUMES

Item	Item specified when size of field was					Total
	1 to 5 acres	6 to 10 acres	11 to 20 acres	21 to 50 acres	51 to 100 acres	
Estimates number	136	112	55	43	7	353
Legumes acres	459	905	852	1409	520	4145
Acres per estimate	3.4	8.1	15.5	32.8	74.3	11.7

COTTON AFTER WINTER LEGUMES

Estimate number	59	34	31	18	5	147
Legumes acres	202	291	474	535	375	1877
Acres per estimate	3.4	8.6	15.3	29.7	75.0	12.8

Reference: Table 2, page 3, Technical Bulletin 367, U. S. D. A. Washington, D. C.

It will be noted that the fields of corn following winter legumes averaged 11.7 acres, while the cotton averaged 12.8 acres. On all the size groups, the acreage per field for cotton and for corn was practically the same, except in that ranging from 21 to 50 acres.

FOOTNOTE TABLE 2—AVERAGE DATES OF SOWING VETCH AND WINTER PEAS.

Legume and section	For cotton		For corn	
	Reports	Sowing dates	Reports	Sowing dates
	Number		Number	
Vetch:				
North of 33°	31	Oct. 15	102	Oct. 15
South of 33°	10	Oct. 27	83	Oct. 22
Winter peas:				
North of 33°	14	Oct. 20	13	Oct. 19
South of 33°	42	Oct. 17	109	Oct. 20

Reference: Table 12, page 22, Technical Bulletin 367, U. S. D. A., Washington, D. C.

Note— The 33° line of latitude passes through Noxubee, Winston, Attala, Holmes, Humphreys, Sharkey and Issaquena counties.

FOOTNOTE TABLE 3—AVERAGE DATE OF TURNING UNDER VETCH AND WINTER PEAS AND OF PLANTING THE FOLLOWING CROPS

Legume and section	FOR COTTON				
	Estimates on—		Date of—		Interval
	Turning	Planting	Turning	Planting	
	Number	Number			Days
Vetch:					
North of 33°	39	39	Apr. 23	May 8	15
South of 33°	10	10	Apr. 20	May 1	11
Winter peas:					
North of 33°	14	14	Apr. 19	May 10	21
South of 33°	44	45	Mar. 29	Apr. 19	21

FOR CORN

Vetch:					
North of 33°	110	113	May 4	May 19	15
South of 33°	86	86	Apr. 26	May 13	17
Winter Peas:					
North of 33°	14	14	May 1	May 12	11
South of 33°	112	112	Apr. 11	Apr. 28	17

Reference: Table 13, page 25, Technical Bulletin 367, U. S. D. A., Washington, D. C.

FOOTNOTE TABLE 4—PERCENTAGE OF CROP LAND DEVOTED TO VETCH AND WINTER PEAS ON FARMS OF SPECIFIED SIZE

Size group (crop acres per farm)	Farms*	Crop acreage		Acreage in vetch and winter peas		Percentage of crop acreage
		Total	Weighted average per farm	Total	Weighted average per farm	
0 to 50	50	2,096	42	355	7.1	16.9
51 to 100	109	8,842	81	903	8.3	10.2
101 to 200	115	19,284	168	1,733	15.5	9.2
201 to 400	49	13,886	283	802	16.3	5.8
401 to 600	43	23,825	554	1,129	26.2	4.7
Over 600	20	27,375	1,369	581	29.5	2.1
Totals and weighted averages	386	95,302	247	5,553	14.4	5.8

*Some farmers gave estimates for more than 1 year.

Reference: Table 14, page 28, Technical Bulletin 367, U. S. D. A., Washington, D. C.

TABLE 2—AVERAGE INCREASE IN YIELD, COST, AND NET GAIN PER ACRE FROM THE USE OF WINTER LEGUMES FOR CORN AND COTTON

Item	Corn*		Cotton**	
	At high prices	At low prices	At high prices	At low prices
	Dollars	Dollars	Dollars	Dollars
Value of increase in yield\$	14.10	7.05	18.00	7.00
Value of legume pasture and hay	.63	.30	.30	.15
Total	14.73	7.35	18.30	7.15
Net cash cost†	2.87	1.88	3.80	2.39
Net non-cash cost†	2.67	1.48	4.81	2.52
Total net cost	5.54	3.36	8.61	4.91
Net gain all costs considered	9.19	3.99	9.69	2.24
Net gain, only cash costs considered	11.86	5.47	14.50	4.76

*4,145 acres with increase in yield per acre of 14.1 bushels.

**1,877 acres with increase in yield per acre of 100 pounds lint.

§Corn is valued at \$1 a bushel, high-prices and 50 cents a bushel, low prices. Cotton is valued at \$90 a bale, cottonseed included, at high-prices, which is approximately 15 cents per pound of lint; and \$30 per ton of seed and \$35 a bale, at low-prices, which is approximately 6 cents per pound of lint and \$10 per ton of seed.

†Taken from the last 2 lines of Table 1.

Other conditions same as in Table No. 1.

Reference: Table 8, page 14, Technical Bulletin 367, U. S. D. A., Washington, D. C.

B. INCREASED YIELD OF SUCCEEDING CROPS.

How much increased yield per acre may be expected on cotton from a crop of winter legumes? On corn? How does cover crop compare with nitrate of soda in producing cotton and corn?

TABLE 3—COTTON FOLLOWING COVER CROPS

Fertilizer N-P-K	Cover Crops	Yield in pounds seed cotton per acre										8 Year Average
		1926	1927	1928	1929	1930	1931	1932	1933	1934		
No nitrogen in fertilizer												
0-9-5	and Aus. Winter Peas	1286	817	594	1405	1020	2217	1293	2135	1346		
0-9-5	and Montantha Vetch	947	958	667	1165	1071	1510	1130	1882	1166		
0-9-5	and Hairy Vetch	863	758	602	773	1012	1710	1010	2392	1140		
0-9-5	and Rye	960	895	577	885	830	1312	1233	1602	1037		
0-9-5	and No Cover Crop	691	683	422	717	322	1127	865	1125	744		
Nitrogen in fertilizer												
3-9-5	and Aus. Winter Peas	1294	793	696	1223	1189	1917	1283	2255	1331		
3-9-5	and Monantha Vetch	1228	973	802	1513	1473	1922	1220	2395	1441		
3-9-5	and Hairy Vetch	1230	865	807	1388	1147	1837	1233	2625	1391		
3-9-5	and Rye	1189	917	820	985	1271	1895	1095	2270	1305		
3-9-5	and No Cover Crop	956	786	662	965	447	1485	1092	1750	1018		

Reference: Georgia Coastal Plain Experiment Station Bulletin 21, page 44, Tifton, Georgia.

Cotton Variety: Petty's Toole.

Winter Cover Crop turned March 1st; cotton planted first week in April. No fertilizer was applied to cover crop.

Fertilizer: 1000 pounds per acre of the formula indicated.

Soil Type as given by the Tifton experiment station: "Sandy loam underlaid with firm subsoil." "Typical Tifton Sandy Loam." As given by the U. S. Bureau of Chemistry and Soils in "Soil Survey of Worth County, Georgia." "Tifton sandy loam is commonly known as "red pebbly" or "pimply" land. Typically, the surface soil consists of grayish-brown or brownish-gray loamy sand that is slightly heavier textured than the surface layer. The subsoil at a depth ranging from 8 to 15 inches is yellow or bright-yellow friable sandy clay. . . . It is slightly sticky. . . ." Quite similar to the sandy loam soils of South Mississippi.

Tifton, Georgia, is practically in the same latitude as Laurel, Brookhaven and Natchez, Mississippi. (Latitude 31.50, Longitude 83.50°.)

For green weights of cover crop in connection with the experiment, see Table 20, Cut March 1.

The land used for this test has been in cultivation about 40 years. The same land was not used every year of the test, but no record is available of the rotations used. No record is available of the crops grown on the land before the experiment was begun.

The cotton and corn green manure work recorded in this experiment and table 16 is planted on the same two acres every year, but cotton follows on the corn acre, and corn on the cotton acre. The acre that has corn this year will have cotton on it next year. The same two acres have been used throughout this test.

Rate of Seeding—Austrian Winter Peas, 40-45 pounds per acre. Monantha Vetch, 35 pounds, Hairy and smooth Vetches, 30 pounds per acre, Rye, 2 bushels per acre.

Date of seeding cover crop—About October 20.

Method of planting cover crop—The land was disked with a heavy disc harrow and dragged with a section harrow before planting, then planted with 2-horse 8-disc grain drill.

Method of turning cover crop—(1) Land broken with large 2-horse turning plow; (2) Disked and section harrowed; (3) Bedded for planting. Cotton planted on beds.

Checked and approved by J. C. Walters, Georgia Coastal Plain Experiment Station, Tifton, Georgia.

TABLE 4—RYE AND VETCH VERSUS MANURE FOR SOIL IMPROVEMENT WHEN COTTON IS GROWN ON THE SAME LAND EACH YEAR.

	1926	1929	Pounds Seed Cotton	Per Acre	1933	Average	1934
Plot 1—check	470	800	1020	865	1700	.....	.....
Plot 2—8 T. fresh manure	610	1060	1340	1035	2046	.....	.....
Plot 3—Rye and Vetch	470	1060	1000	1175	1902	.....	.....
Plot 4—8 T. fresh manure, rye and vetch	775	1330	1750	1575	2588	.....	.....

Reference: Farms Department, S. C. Experiment Station, Clemson College, S. C.

In 1927 and 1928 no record of yield was kept as stand was irregular on all plots.

There was a poor stand on plot 4 in 1933 which probably cut the yield on this plot 500 pounds per acre.

Planting date of cover crop—Abruzzi Rye and Hairy Vetch, Sept. 15 to Oct. 15

Fertilizer applied to cover crop—None.

Fertilizer applied to cotton—600 pounds 4-9-3 per acre at time of planting—150 pounds nitrate of soda as side dressing.

Seeding rates of cover crops—15 pounds vetch and 1½ bushels rye per acre.

Seeding rates of cotton—1½ bushels cotton seed per acre.

Variety—Dixie Triumph No. 25 Cotton Seed.

Rotation Used—None.

Date of turning cover crop—March 1.

Date of planting cotton—April 15 to April 25.

Soil type—Cecil Sandy Loam—In plowed fields, it has a surface layer of light brown or gray sandy loam extending to a depth ranging from 4 to 14 inches. The color tends to become lighter and more gray after long cultivation. This layer is underlain by a surface layer of reddish-yellow friable heavy sandy loam, usually 4 to 6 inches thick. (U. S. Bureau of Chemistry and Soils.)

Number years that land on which test was run has been in cultivation—Not known. Probably 50 to 75 years.

Crops on land for last two years before experiment was begun? Cotton. Fertilizer applied—600 pounds 4-9-3 and 150 pounds Nitrate of Soda. Yields—Not available.

Plot No. 1 was selected as the most fertile at the beginning of this test.

Has test been run continuously on the same land? Yes.

Clemson College, S. C., is on about the same latitude as Booneville and Senatobia, Mississippi.

TABLE 3—WINTER COVER CROPS—ST. JOSEPH, LOUISIANA—(Delta)

Check	Yield Green Matter				Yield of Cotton				Increase over check				4 Yr.		4 Yr. Last First	
	1929-30	1930-31	1931-32	1932-33	Average	1930	1931	1932	1933	1930	1931	1932	1933	Av.	3 Yr.	Av.
150 Nitrate of Soda						1045	1144	990	1306	1121	128	701	526	429	530	397
Austrian Winter Peas	7044	43,500	22,048	23,522	24,028	1173	1507	1691	1832	1551	128	660	1021	856	761	729
Oreg. Smooth Vetch	6722	42,350	36,300	26,136	27,877	1553	1804	2011	2162	1882	508	660	1021	856	761	845
Hairy Vetch	9276	51,626	No wt.	**		1476	1791	2420	2323	2002	431	647	1430	1017	881	836
Monantha Vetch	No wt.	64,533	41,946			1617	1960	*			571	816	*			
Mellilotus Indica	No wt.	4,024	14,251	No wt.		1129	2551	2472	2107	2065	84	1407	1482	801	943	1230
Red Clover	No wt.	36,703	No wt.			886	1225	1894			81	964				
Crimson Clover	No wt.	No wt.	No wt.			1113	1882	2156			68	738	1166			657
Abruzzi Rye	1479	6,250	3,746			1132	1146	1639			87	2	649			246
Oreg. Hairy Vetch		52,432	25,813	24,829		655	974	1003			—390	—170	13			—182
Hungarian		54,853	32,470	28,069			2070	2200	2182			926	1210	876		1004
							2148	2562	2261			1004	1572	955		1177

*Due to heavy infestation of wilt in cotton yields not given.

**No stand, poor seed.

ALL YEARS

Cover crops drilled in middles by hand and covered by middle e-bursting middles. All cotton hill dropped 16 inches in 40 inch rows averaging 6 to 8 stalks per hill. Method of turning crop—disk, double. Rate of seeding—Hairy vetch, 14 pounds; Monantha and Hungarian, 18 pounds; Winter Peas, 24 pounds; Bur clover, 50 pounds in bur in September; mellilotus, 6 pounds; Rye, 1 bushel.

1929-30

Cover crops were planted on flat broken land November 6. Freeze November 28. Killed all, listed no weight. Crops were turned April 21. Cotton planted May 6. Variety—Express, 1930 and 1931.

1930-31

Mellilotus Alba and crimson clover seed evidently poor as very few plants of either came up and growth was very small. Mellilotus Indica also made very poor growth due probably to lack of inoculation. Cover crops were planted in old cotton middles October 14. Season unusually favorable. Turned under April 10. Cotton planted April 27.

1931-32

Crops listed as yielding no weight made considerable growth but were so spread out and beaten down by heavy rains that no accurate yield could be estimated. Cover crops were planted in old cotton middles October 21 and turned under April 27.

1932-33

Cotton planted April 18. Killed by hail May 1. Planted over May 6. Nitrate of Soda applied as side dressing May 22. Cotton dusted every year except 1933. In 1930, one dusting in spots; 1931, five times; 1932, three times. This includes all cotton. Cover crop planted October 10. Turned under April 4.

Soil type—Light sandy loam; badly worn, 100 years old. Same plots used for cover crop in 1930, 1931 and 1932. In 1933 a different plot was used. This soil is light sandy loam of Alluvial type.

Inoculation—Commercial one year only.

TABLE 6—THE EFFECT OF ROTATION AND COMMERCIAL FERTILIZER ON THE YIELD OF COTTON AT HOLLY SPRINGS, MISSISSIPPI

Yields in pounds of seed cotton per acre.										
	1925	1926	1927	1928	1929	1930	1931	1932	1933	7 Yr Av.
1. Cotton continuously without fertilizer	1561	1213	824	786	763	714	390	.....	.....	893
2. Cotton continuously and 600 lbs. 4-8-8	1996	2065	1238	1605	1814	1414	682	.....	.....	1545
3. Cotton in rotation and 600 lbs. 4-8-8	1550	1973	1637	2148	2401	1970	1061	.....	.....	1820

Reference: Bulletin No. 296 Mississippi Agricultural Experiment Station, Table 14, page 11.

"In 1925 a cotton fertilizer test was started on one of these tracts and has been repeated annually without cover crops. The adjoining tract of six acres was divided into two, three-acre plots and continued in a rotation as follows: first year, cotton followed by vetch and the vetch allowed to mature; second year, Corn or silage followed by a volunteer crop of vetch, occasionally cut for hay; and third year, cotton. The volunteer vetch was plowed under about the first week in time for planting cotton April 21. Cotton was alternated from one plot to the other with corn and soybeans, or sorghum. Each year the rotation plot received an application of 600 pounds of 4-8-8 fertilizer, which is the same treatment given the continuous cotton plot."

The averages for the first seven years are as follows:

Plot 1	First 4 years	1096	Last 4 years	663.
Plot 2	First 4 years	1726	Last 4 years	1379.
Plot 3	First 4 years	1827	Last 4 years	1895.

TABLE 7—WINTER LEGUMES VERSUS COMMERCIAL NITROGEN ON THE YIELD OF COTTON 1928-33 AT RAYMOND, MISS.

Plot Treatment		Increase over no nitrogen check (Pounds seed cotton per Acre)					5-year average
Fertilizer 800 lbs. per A.	Cover Crop	1929	1930	1931	1932	1933	
6-8-4	None	503	383	597	445	597	505
0-8-4	Hairy Vetch	168	380	344	313	344	309
0-8-4	Monantha Vetch	252	125	374	126	374	250
0-8-4	Burr Clover	58	42	321	242	321	157
0-8-4	Crimson Clover	5	64	6	235	6	33
0-8-4	Aus. Winter Peas	170	32	152	335	152	153
Check plot yield							
0-8-4	None	1061	1207	783	576	919	909

Reference—1934 Report Raymond Branch Experiment Station, Raymond, Miss.

"The purpose of this test is to determine how much nitrogen is stored in the soil by various winter legumes. This legume nitrogen is tested against commercial nitrogen. This test is in four series and records for five years are available. The no legume plots carry 800 pounds of a 6-8-4 per acre except in one instance, we use a check which receives no nitrogen in any form. It does get 800 pounds of an 0-8-4 per acre as do all the legume plots. Vetch and Austrian peas have grown well each year, monantha vetch was damaged by cold two years, crimson clover was damaged two years and killed one year, and bur clover has had only one perfect stand, with thin stands the other four years. This test is continued and a companion test under new work was started last fall."

Planting date of cover crop—October 6, 1932.

Planting date of cotton—May 9, 1933.

Fertilizer applied to cover crop—None.

Method of seeding cover crop—Broadcast.

Seeding rates of cover crops—20 pounds for vetch, 30 pounds for peas, and 12 pounds for clover.

Seeding rates of cotton—1½ bushels per acre.

Variety of cotton—Lone Star.

Rotation used—None.

Date of turning cover crop—Turned April 2, 1933.

Spacing of cotton between rows and in drill—2 stalks per hill, 1 foot on 3½ foot rows.

Soil type—Brown loam—Type, Olivier, bottom land. The surface soil is a light brown to grayish-brown silt loam 8 to 14 inches deep with an average depth of about 10 inches. It has a smooth feel, and when dry is mellow and friable. When wet it is of a pasty consistency. The subsoil consists of a bluish-gray or mottled gray and brown, plastic silt loam or silty clay loam, which becomes quite compact at about 23 inches. Typically the brown silt loam passes gradually into the mottled gray and brown material.—(U. S. Bureau Chemistry and Soils.)

Number of years that land on which test was run has been in cultivation—14 of a certainty and 75 by hearsay

Crops on land for last two years before experiment was begun—Cotton, oats and vetch. Fertilizers applied—600 pounds 6-8-4 per acre. Yields—Half bale approximately; 300 pounds seed cotton on checks.

Test run continuously on same land.

Rainfall or temperature data of importance—Wet springs—dry summers.

Monantha vetch froze out in 1932, and in 1933, crimson clover in 1932, and no stand of bur clover in 1933.

Insects and diseases of cover crop—None to any noticeable extent.

TABLE 8—AVERAGE YIELD PER ACRE OF COTTON GROWN AFTER WINTER LEGUMES, BY SPECIFIED INCREASES IN YIELD

Increase in yield (pounds of lint)	Yield of lint per acre			
	Acres studied	After legumes	Not after legumes	Increase
Decrease	Acres	Pounds	Pounds	Pounds
No Increase	55	122	298	—176
1 to 50	284	306	306	0
51 to 100	195	315	282	33
101 to 150	487	377	291	86
151 to 200	470	405	270	135
201 to 250	210	492	306	186
Over 250	121	473	240	233
Over 250	55	593	272	321
Total and weighted average	1,877	381	281	100

Reference: Table 11, page 18, Technical Bulletin 367, U. S. D. A., Washington, D. C.
Other conditions same as in Table 1.

It will be noted that the yield was decreased on 55 acres on which cover crops were grown, and that there was no increase in 284 acres more.

TABLE 9—THE EFFECT OF LEGUMES TURNED UNDER ON THE YIELD OF SUCCEEDING CROPS

Plot	Cropping System	First 10 Yrs. 10 Yrs.		Corn (Bushels per acre)														11-yr. 13-yr.	
		1896-1905	1906-1915	1920	1921	1922	1923	1924*	1926	1927	1928	1929	1930	1931	1932	1933	Av.	1934	
1	Corn each year peas last cultivation†	.....	19.2**	16.2	16.2	19.3	16.8	17.7	16.7	16.1	26.5	30.9	33.8	.....	x	.....	.....	.....	
2	Corn each year, no peas	.....	17.3	10.2	9.2	9.6	7.6	7.1	8.0	12.9	9.8	9.4	8.9	.....	x	.....	.....	.....	
4 & 7	(Two-year Rotation) Cotton and vetch Corn & vetch	.....	.....	14.3	19.1	12.1	10.9	14.8	15.5	22.5	41.6	40.0	.....	.....	.....	.....	.....	.....	
10 11 & 12	3 Yr. Rotation; Cotton, Vetch, Corn, Oats, Cow- peas for hay, vetch	.....	.....	16.7	11.6	17.8	12.0	17.7	16.3	31.7	38.0	25.2	.....	.....	.....	.....	.....	.....	
1	Corn each year. Peas at last cultivation†	Cotton (Pounds seed cotton per acre)																x	
	(Changed to cotton each year in 1932 and legumes discontinued)	Study of residual effect of legumes																x	
2	Corn each year. No peas Change to cotton each year in 1932.	Study of residual effect of legumes																x	
3 & 8	Cotton and Vetch contin- uously. Vetch as cover crop	813	678	419	414	1024	445	926	1161	1477	618	1079	.....	.....	.....	.....	.....	.....	
4 & 7	(Two-year Rotation) Cotton and Vetch. Corn and Vetch	.....	.....	555	392	840	725	1347	1146	1714	537	1283	.....	.....	.....	.....	.....	.....	
5 & 9	(Two-year Rotation) Cotton and Vetch. Cowpeas§	890	958	1117	578	1430	1120	1504	1411	1483	621	1144	.....	.....	.....	.....	.....	.....	
6	Cotton continuously, no legumes	803	573	307	227	546	152	470	419	586	254	536	.....	.....	.....	.....	.....	.....	
10, 11 & 12	3 Yr. Rotation; cotton, vetch, corn, oats, cowpeas for hay, vetch	.....	.....	237	499	720	909	1155	1027	1235	432	1396	.....	.....	.....	.....	.....	.....	

Reference—Alabama Bulletin No. 232, Table 1, page 6, Auburn, Alabama.

xPlots 1 and 2 have been discontinued in corn since 1931. They are now being planted to cotton to test the residual effect of the cover crops planted heretofore. They are receiving no nitrogen and no cover crop.

*Results omitted in 1925 due to extremely dry weather. Results not comparable.

†Changed to corn and vetch in 1925.

§In 1932 and after, peas cut for hay and followed by vetch.

**Only 9 crops.

In the fall of 1921, 400 pounds of superphosphate was applied to the west half of each plot. This was repeated on the same half of each plot in the fall of 1922. The east half of all plots received 800 pounds of superphosphate in the spring of 1923 to equalize the phosphate application. In the fall of 1923, and each fall since, 400 pounds of superphosphate per acre have been applied to the whole of each plot. All plots in experiment got 400 pounds superphosphate in the fall except plot 8, and it was only delayed until spring. All cotton and corn plots received 160 pounds superphosphate and 160 pounds of kainit each year at planting time. Seeding rate of hairy vetch—25-30 pounds.

Average yields of green matter from cover crops for 1926, 1927, and 1929, were as follows: Plots 1, 12,918 pounds; Plots 3 and 8, 9,570 pounds of green vetch, and Plots 5 and 9, 10,904 pounds green vetch.

Planting date of cover crop? After the first rain in September. None planted after October 15.

Date of turning cover crop? About April 1.

Date of planting cotton and corn? About April 15.

Variety of succeeding crops—Whatley corn and Cook cotton.

Soil type—Typical of no particular type. It is in the main a mixture of Norfolk and Cecil sandy loams overlying a Cecil subsoil.

Number of years that land on which test was run has been in cultivation? Known to have been in cultivation 38 years. No record of how much longer.

Has test been run continuously on the same land? Yes.

Width of rows—3½ ft. for cotton; 5½ ft. for corn.

Spacing: Corn, 1 stalk every 27 inches; cotton, 2 stalks every 18 inches.

The cover crop plots were not grazed.

Size of plots—1-16 acre.

Boll weevils were poisoned when the infestation got above 10%

Bud worms gave some trouble practically every year following vetch. No control measures were used. The corn was replanted when necessary. No commercial nitrogen was applied to any of these plots.

Auburn is just a little north of the latitude of Meridian, Jackson and Vicksburg, Mississippi.

Checked by E. L. Mayton, Alabama Agricultural Experiment Station, Auburn, Ala.

TABLE 10—INFLUENCE OF LEGUMES TURNED UNDER ON YIELD OF COTTON AND CORN

Plot	Fertilizer treatment Pounds per acre.	Legumes in the cropping system*	1921	1922	1923	1924**	1926	1927	1928	1929	1930	1931	1932	1933	12 Yr. Av.
			Cotton (Lbs. seed cotton per acre.)												
A	240 Superphosphate 50 Muriate of potash	Summer and winter	.....	242	648	210	406	1042	751	270	546	.....	.....	.....	.....
		None	.....	66	194	48	72	166	208	60	124	.....	.....	.....	.....
B	240 Superphosphate 50 Muriate of potash	None	.....	84	132	36	52	184	238	30	30	.....	.....	.....	.....
		Summer and winter	.....	102	324	152	120	654	264	39	114	.....	.....	.....	.....
A	240 Superphosphate 50 Muriate of Potash	Summer and winter	.....	30.7	20.2	24.4	36.4	37.1	42.0	21.8	43.4	.....	.....	.....	.....
		None	.....	13.2	7.1	7.7	9.3	7.1	9.0	4.7	4.5	.....	.....	.....	.....
C	None	None	.....	16.4	8.3	13.3	15.1	11.8	12.9	5.7	10.7	.....	.....	.....	.....
		Summer and winter	.....	24.8	18.2	24.4	30.0	23.9	20.9	6.5	18.3	.....	.....	.....	.....

Reference: Ala. Bulletin No. 232. Table No. 2, page 8. Auburn, Alabama.

*Two year average yields of green matter turned under were: Plot A, 9 661 and Plot 1, 2 311 pounds per acre.

**1925 yields omitted because of extremely dry weather, so that yields are not comparable.

Planting date of cover crop? September 1—October 15.

Fertilizer applied to cover crop? None.

Seeding rates of cover crops? 25-30 pounds Hairy Vetch per acre.

Variety of succeeding crops—Cook wilt resistant Cotton and Whatley Corn.

Rotation used, 3 year rotation—cotton; oats followed by cowpeas for turning; corn. Changed in 1932 so that oats follow corn.

Date of turning cover crop? April 1.

Date of planting succeeding crop? April 15.

Description of soil type—Hill land—Norfolk Sandy loam—"Has a surface soil of grayish brown or brownish gray sandy or loamy sand, which in the lower part of the plow soil becomes more yellow and a little more loamy. Below this, the subsoil grades from the overlying sandy materials into yellow somewhat firm friable fine sandy clay, which with depth, becomes firmer. A few brown iron "pebbles" occur in places on the surface and through the soil materials."—(Bureau of Chemistry and Soils.)

Has test been run continuously on the same land? Yes.

Width Rows—3½ ft. for cotton; 5 ft. for corn.

Spacing—Cotton, 2 stalks every 18 inches, roughly; corn, 1 stalk every 27 inches.

Cover crop plots not grazed.

Size of plot—1-20 acre.

Budworms injured the stand of corn on the Vetch plots more commonly than any of the other plots. Austrian winter peas were discontinued after 1932 on account of Anthracnose. Hairy vetch in 1933 and since.

The yields through 1931 may be averaged. In 1932 the rotation in the experiment was changed to corn, oats, cotton instead of corn, cotton, oats, and superphosphate applications increased to 375 pounds per acre to cotton and corn.

TABLE 11—INFLUENCE OF STABLE MANURE, NITRATE OF SODA, AND VETCH ON YIELDS OF COTTON AND CORN

Plot	Fertilizer treatment			Cotton (Pounds seed cotton per acre)									Av.	1934
	Pounds per acre.	1925	1926	1927	1928	1929	1930	1931	1932	1933				
1	No fertilizer No cover crop	324	484	321	216	266								
2	5 tons manure 400 Superphosphate	680	1704	1480	2082	1412								
3	325 Nitrate of Soda 600 Superphosphate 100 Muriate of potash	589	1612	1075	1714	1118								
4	Vetch 600 Superphosphate** 100 Muriate of potash	589	1806	1626	970†	1162				†				
5	No fertilizer No cover crop	321	498	426	338	116	Corn (Bushels per acre)							
6	No fertilizer No cover crop	7.3	6.7	5.3	7.1	10.5								
7	5 tons manure	11.1	37.9	32.2	59.5	49.0								
8	325 Nitrate of Soda 200 Superphosphate 100 Muriate of potash	12.3	43.5	38.0	46.7	37.9								
9	Vetch* 400 Superphosphate** 100 Muriate of potash	10.5	44.9	40.8	31.4†	27.7†					†			
10	No fertilizer No cover crop	5.9	7.3	8.7	7.6	13.1								

Reference: Alabama Bulletin 232, Table 3, page 12, Auburn, Alabama.

†Residual effect: Winter legume destroyed during winter before this crop was planted.

*One ton of lime per acre was applied to plots 4 and 9 every 5 years.

**Plots 4 and 9 received 400 pounds of superphosphate and 100 pounds of muriate of potash per acre in the fall when vetch was planted. The plot on which cotton was planted received 200 pounds of superphosphate at cotton planting time.

Beginning in 1931 plots 1 and 5 planted to cotton received 600 pounds superphosphate and 100 pounds muriate potash per acre annually. Plots 6 and 10 planted to corn, received 200 pounds superphosphate and 100 pounds muriate of potash per acre annually.

Monantha vetch on plots 4 and 9 killed by cold in 1928. Austrian winter peas planted on these plots in January produced only 1900 pounds of green matter per acre. Rabbits damaged vetch and Austrian winter peas on plot 9 so severely in 1929 that only 809 pounds of green matter per acre were produced. In 1932, Austrian winter peas on these plots were completely destroyed by rabbits.

Planting date of cover crop—After the first rain in September. Never after October 15.

Seeding rates of cover crops—25-30 pounds Hairy Vetch. Austrian Winter Peas used first 4 years, but discontinued on account of Anthracnose. Practically no difference secured in yields from vetch and peas.

The peas were seeded at 40 to 45 pounds per acre.

Date of turning cover crop—About April 1.
 Date of planting cotton and corn—April 15.
 Variety of succeeding crop—Cook wilt resistant cotton; Whatley corn every year except 1932. Indian Chief that year.
 Soil type—Norfolk sandy loam. For description see Table 10.
 Number of years that land on which test was run has been in cultivation—At least 22 years.
 Has test been run continuously on the same land? Yes.
 Budworms destroyed enough corn on the cover crop plots each year that some re-planting had to be done. The cover crop plots had to be planted over in 1934.
 Cotton and corn both on 4 ft. rows.
 Spacing—Corn, 1 plant every 27 inches; Cotton, 2 plants every 18 inches, roughly.
 Cover crop plots not grazed.
 Size of plots—1-20 acre.
 Checked by E. L. Mayton, Alabama Agricultural Experiment Station, Auburn, Ala.

TABLE 12—NUMBER OF FIELDS, TOTAL ACREAGE, AVERAGE ACRES PER FIELD, AND AVERAGE YIELD OF CORN AND COTTON GROWTH AFTER SPECIFIED WINTER LEGUMES

	Fields		Average size of field	Average yield per acre				
				After Winter Legumes		Not After Winter Legumes		Increase per acre
	No.	Acres	Acres	Bu. or Lbs.	Bu. or Lbs.	Bu. or Lbs.	Percent	
Corn after vetch	202	2,393	11.8	33.3	19.6	13.7	70	
Cotton after vetch	62	818	13.2	389	280	109	39	
Total or average	264	3,211	12.2	.....	.....	.....	.....	
Corn after Austrian Winter peas	129	1,568	12.2	34.8	20.4	14.4	71	
Cotton after Austrian Winter peas	64	922	14.4	356	271	85	31	
Total or average	193	2,490	12.9	.....	.....	.....	.....	
Corn after Crimson Clover	18	151	8.4	43.5	24.4	19.1	78	
Cotton after Crimson Clover	14	93	6.6	538	384	154	40	
Total or average	32	244	7.6	.....	.....	.....	.....	
Corn after Bur Clover	4	33	8.2	23.5	15.0	8.5	57	
Cotton after Bur Clover	7	44	6.3	391	293	98	33	
Total or average	11	77	7.0	.....	.....	.....	.....	
Total Corn	353	4,145	11.7	34.1	20.0	14.1	70	
Total Cotton	147	1,877	12.8	381	281	100	35	
Grand total or average	500	6,022	12.0	.....	.....	.....	.....	

Combination of Tables 1 and 3, Technical Bulletin 367, U. S. D. A.—“The Use of Winter Legumes in the Southeastern States.”
 Conditions as in Table 1.

TABLE 13—AVERAGE YIELD PER ACRE OF CORN GROWN AFTER WINTER LEGUMES, BY SPECIFIED INCREASES IN YIELD

Increase in yield (bushels)	Acreage studied	Yield per acre		
		After legumes	Not after legumes	Increase
	Acres	Bushels	Bushels	Bushels
Decreases	62	15.1	22.4	*7.3
No increase	357	19.2	19.2	0
1 to 5	408	21.8	17.0	4.8
5 1/2 to 10	908	28.9	19.8	9.1
10 1/2 to 15	1,071	35.0	20.3	14.7
15 1/2 to 20	559	38.3	19.2	19.1
20 1/2 to 25	427	46.4	22.7	23.7
25 1/2 to 30	132	54.2	25.3	28.9
Over 30	221	56.8	18.6	38.2
Total and weighted average	4,145	34.1	20.0	14.1

*Decrease.
 Reference: Table 10, page 16, Technical Bulletin 367, U. S. D. A.
 Other conditions same as in Table 1.

TABLE 14—YIELD CORN FOLLOWING COVER CROP

Fertilizer N-P-K	Cover Crops	1926	1927	1928	1929	1930	1931	1932	1933	8-Year Av.	1934
No nitrogen in fertilizer											
0-10-4.....	and Aus. Winter Peas	58.0	50.1	54.9	70.4	57.3	45.2	63.5	52.9	56.5	.....
0-10-4.....	and Monantha Vetch	44.4	37.7	27.3	73.1	47.8	42.6	63.0	64.1	50.0	.....
0-10-4.....	and Hairy Vetch	42.6	39.7	24.7	56.0	53.8	48.7	62.8	52.9	47.6	.....
0-10-4.....	and Rye	36.4	33.2	34.8	41.0	33.3	29.4	30.7	36.5	34.4	.....
0-10-4.....	and No Cover Crop	35.1	34.6	29.5	50.5	34.9	42.8	38.3	35.0	37.6	.....
Nitrogen in fertilizer											
2-10-4.....	and Aus. Winter peas	47.9	43.4	48.8	73.9	50.0	41.1	63.8	52.7	52.7	.....
2-10-4.....	and Monantha Vetch	43.0	37.6	29.0	74.1	55.6	47.5	65.2	67.8	52.5	.....
2-10-4.....	and Hairy Vetch	53.3	38.3	33.5	65.1	53.2	46.6	62.9	56.1	51.1	.....
2-10-4.....	and Rye	33.7	38.2	39.3	51.2	38.1	32.8	35.8	41.1	38.8	.....
2-10-4.....	and No Cover Crop	41.5	41.4	33.7	46.8	31.5	39.9	43.2	39.4	39.7	.....

Reference: Georgia Coastal Plain Experiment Station Bulletin 21, page 43, Tifton, Georgia.

Fertilizer—500 pounds per acre of indicated analysis at planting time. No side dressing.

Fertilizer applied when summer crop was planted. Nitrogen included in the fertilizer on one acre and omitted on the other as indicated.

Cover crop turned March 15. Corn usually planted first week of April. Whatley's Prolific Corn used. No fertilizer was applied to cover crop.

Planting date of corn: Usually before April 10. Corn planted in water furrow. Soil type and other conditions same as Table 3.

For green weights of cover crops in connection with this experiment, see Table 20. Cut March 15.

Checked and approved by J. C. Walters, Georgia Coastal Plain Experiment Station, Tifton, Georgia.

TABLE 15—WINTER COVER CROP TEST ON CORN WITHOUT FERTILIZER

Cover Crop	Bushels of corn per acre						Increase Over check	1934
	1929	1930	1931	1932	1933	Ave.		
None—check	27.2	22.4	37.4	27.4	37.2	30.3	....	.....
Vetch	40.3	20.8	39.6	32.4	45.1	35.6	5.3	.....
Crimson Clover	32.9	20.4	38.0	31.4	44.9	33.5	3.2	.....
Rye	24.9	17.2	40.0	28.3	38.9	29.9	—4	.....

Reference: Unpublished data from Central Station, State College, Miss.

Planting date of cover crop—October 1 to 15.

Planting date of corn—May 10 to 20.

Fertilizer applied to cover crop—None; Fertilizer applied to corn—None.

Seeding rates of cover crops—Vetch, 20 to 25 pounds; crimson clover, 15 pounds; rye, 5 pks.

Spacing of corn—one stalk every 30 inches in 42-inch rows in all years except 1932 and 1933. Those years, checked two stalks every 42 inches.

Variety of corn—Cocke's Prolific.

Date of turning cover crop—April 5 to 20.

Soil type—Ochlockonee loam. Very similar to the Ochlockonee fine sandy loam except that it has considerably less sand.

Ochlockonee fine sandy loam—Bottom land of grayish-brown or brown loamy fine sand or fine sandy loam, grading at a depth of 2 or 4 inches into brown or yellowish brown loamy fine sand or fine sand. There is considerable variation in this soil. The subsoil in many areas is poorly drained and remains moist.

Number of years that land on which test was run has been in cultivation—40 years.
Crops on land for last two years before experiment was begun—corn both years.

Yields—not available. Fertilizers applied—not known.

Test has been run continuously on same land.

Vetch and rye sown in middles and covered by running middlebuster in middles.

The seed bed for Crimson Clover was pulverized with a Gee Whizz and covered lightly with V-harrow.

C. RESIDUAL EFFECT:

Does a winter cover crop affect the yield of summer crops after the first year?

Consult Table 31. The vetch on this experiment was killed in January 1928. Therefore, the yields of corn in 1928 on the vetch plot got their nitrogen from former crops of vetch. The yields on vetch plots may be compared with the yields on nitrate of soda plots. The average of check plots 1 and 5 for that year is 61 bushels for 18 inch spacing and 7.3 for 36 inch. The average of check plots 5 and 9 for 1928 is 9.9 bushels for 18 inch spacing and 8.3 for 36 inch. The average of check plots 9 and 13 for that year are 12.9 and 7.9 respectively for 18 inch and 36 inch spacings.

D. RISKS

What are some of the risks that must be taken in growing winter legumes?

1. Insect Pests and Diseases of Vetch and Austrian Winter Peas.

A. INSECT PESTS.

THE CORN EARWORM—

Most of the trouble with the earworm on hairy vetch is caused by farmers trying to grow seed. This insect breeds on the vetch and then migrates to the next field and attacks corn, cotton, peach trees and many other cultivated crops.

In case the earworm does develop in the vetch, the first thing to do is to plow a deep furrow around the field in order to prevent the insect migrating. Dig post holes in this furrow to trap them, or sprinkle with poison bait. One of the most effective ways of controlling this insect is to dust in the early morning or late afternoon with calcium arsenate. Another method is to spray the field with a mixture of three pounds of calcium arsenate to fifty gallons of water. The vetch should be plowed under as soon as the poison has taken effect. In case no machine is available, the vetch should be plowed or disked under and poison bait sprinkled over the field. The bait is made as follows: Mix 50 pounds of wheat bran, one pound of Paris green or white arsenate or 2 pounds of lead arsenate, 2 gallons of grade molasses with 3 to 4 gallons of water. Mix the bran and poison together thoroughly, then add the molasses and water and mix thoroughly. Five pounds of salt added to this mixture will help keep it from drying out. Six finely chopped lemons or oranges will give a flavor to the mixture which has been found attractive to the insects. Add enough water to make a moist dough.

In case the earworm should migrate into neighboring fields,

dust or spray with calcium arsenate.—(Bulletin No. 146, Georgia, page 203.) Experiment, Georgia.

APHIDS OR PLANT LICE—

Aphids may do serious damage to winter green-manure crops that are allowed to continue growth late in the spring. However, the proper season for turning the green-manure crop down for cotton or corn is sufficiently early so that usually but little, if any, damage is to be expected. In the northern part of the Cotton Belt aphid damage may be expected after April 15, and in the southern part the last of March or early April. When aphids appear in abundance, the green-manure crop should be turned under or disked down at once.—(Farmers' Bulletin 1663, U. S. D. A., Washington, D. C.)

BUD WORM (Southern Corn Root Worm)—

The bud worm is not distinctly an insect pest of vetch or Austrian Winter peas, but often does considerable damage to corn following these legumes. Table 16 shows the results of a six-year experiment to determine the best time to turn winter legumes to avoid injury from bud worm at Auburn, Alabama.

TABLE 16—SIX-YEAR AVERAGE PER CENT OF CORN PLANTS INFESTED WITH THE BUD WORM, 1927-1932

Date of turning land*	Date of Planting Corn	Average per cent of corn infested following	
		Legumes	No legumes
March 15	March 16	45.7	8.7
March 15	March 23	55.5	7.9
March 15	March 30	39.2	12.2
March 15	April 6	30.5	7.5
March 15	April 13	12.3	6.6
April 1	April 2	49.2	8.3
April 1	April 9	29.6	8.6
April 1	April 16	28.6**	4.3**
April 1	April 23	9.6	4.9
April 1	April 30	3.2	2.0
April 15	April 16	24.7	2.9
April 15	April 23	8.6	2.3
April 15	April 30	2.1	2.0
April 15	May 7	0.6	0.8
April 15	May 14	0.1	0.0

*Approximate date.

**Five-year average; 1933 not included due to mouse injury.

Reference: Circular 65, Alabama, page 8, Auburn, Alabama.

B. DISEASES OF VETCH AND AUSTRIAN WINTER PEAS. ANTHRACNOSE:

The most common form of Anthracnose is *Mycosphaerella* blight characterized by irregular spots, brown to purplish without a definite margin, but may become large and circular under moist conditions. Small, irregular, brown to purplish spots appear on the pods.

Other forms of the disease are foot-rot and leaf-and pod-spot. The foot-rot is confined to the lower stem and tap root where it frequently rots off the plant. Otherwise, this form is very similar to the *Mycosphaerella* blight.

With the leaf-and pod-spot, the spots produced on the pods and leaves are generally circular, but frequently elongated on the stems. The spots are definitely sunken, tan to brown in color and have a prominent dark brown margin.

Late freezes followed by rain seem to be very conducive to the spread of the disease. Very little damage is caused in years when the late winter and spring is dry.

CONTROL—

Probably the most effective control measure for Anthracnose that can be offered to date is to use disease-free seed. The vetch and pea seed obtained from the states in the semi-arid West are more nearly free of disease than seed from any other source. Seed kept over for one year are far more resistant to the disease than seed of the current year. A germination test in 1930 on Austrian Winter pea seed showed the following germination percentages:

Current Years' seed	95% germination
1st year kept over	90% germination
2nd year kept over	60% germination
3rd year kept over	30% germination
4th year kept over	0% germination

The disease is found not to be nearly so prevalent where the plantings are alternated. They should not be planted on the same fields year after year.

POWDERY MILDEW—

Causes the plants to have the appearance of having been dusted with lime, calcium arsenate or flour. It appears only in late, dry spring, on legumes that are kept for hay or seed.

(Adapted from a news letter and statements issued by Dr. J. L. Seal, Plant Pathologist, Alabama Agricultural Experiment Station, Auburn, Alabama.)

2. Other Causes of Failure

TABLE 17—ANALYSIS OF FAILURES WITH WINTER LEGUMES GROWN ON LOUISIANA FARMS

	Austrian W. peas	Hairy vetch	Peas and vetch	Peas or vetch with oats
Number of records	134	41	17	5
No. failures reported	38	7	3	2
No. Failures due to:				
1. Late planting	10	2	0	0
2. Poor drainage	12	4	1	2
3. Poor inoculation	12	1	0	0
4. Improper planting	12	2	2	2
5. Heavy grazing	13	4	0	1
6. Winter killed	10	1	1	0
7. Wet winter and spring	7	1	1	1
8. Unsuitable soil	0	0	0	0
9. Land too poor without phosphate and potash	1	0	0	0
10. Late germination due to dry fall	0	1	0	0

Reference: Extension circular 155, page 5, Extension Service, L. S. U., Baton Rouge, Louisiana.

Two hundred and sixty-four farm records in 20 different parishes were analyzed to determine what conditions were responsible for failure. Most of these records are for the growing seasons 1929-30 to 1932-33, but a few of them date back as far as 1926.

E. VALUE AS GRAZING CROPS:

What are the relative values of winter legumes as grazing crops? How much feed may be saved?

TABLE 18—OATS WITH VETCH OR AUSTRIAN WINTER PEAS AS GRAZING CROPS FOR FATTENING HOGS (Oats and vetch used as pasture first two years of test, 1926, and 1927; Oats and Austrian Winter peas used as pasture second two years 1928 and 1929.)

	Average of first two years (1926 and 1927) of experiment, using Oats and Hairy Vetch as pasture.				Average of last two years (1928 and 1929) using Oats and Austrian winter peas as pasture.				Average for 4 years			
	Lot 1. Corn				Lot 1. Corn				Lot 1. Corn			
	Tankage, Minerals, Self-fed Free Choice O. & V. Pasture.	Lot 2. *Corn 12. Tankage 1 Hand-fed 3% Live weight Minerals, Self-fed O. & V. Pasture.	Lot 3. Corn Tankage Minerals Self-fed Free choice In dry lot In dry lot	Lot 3. Corn Tankage Minerals Self-fed Free choice In dry lot In dry lot	Lot 1. Corn Tankage Minerals Self-fed Free Choice O. & A. W. P. Pasture	Lot 2. *Corn 12. Tankage 1 Hand-fed 3% Live weight Minerals Self-fed O. & A. W. P. Pasture	Lot 3. Corn Tankage Minerals Self-fed Free choice In dry lot In dry lot	Lot 3. Corn Tankage Minerals Self-fed Free choice In dry lot In dry lot	Lot 1. Corn Tankage Minerals, Self-fed Free Choice Pasture	Lot 2. *Corn 12. Tankage 1 Hand-fed 3% Live Weight Minerals Self-fed Pasture	Lot 3. Corn Tankage Minerals Self-fed Free Choice In dry lot	Lot 3. Corn Tankage Minerals Self-fed Free Choice In dry lot
Total No. of Animals	19	18	17	17	20	19	20	20	39	37	37	37
Av. Initial Wt. per animal (pounds)	69	69.5	68.5	68.5	77.05	76.19	77.15	77.15	73.15	72.95	73.19	73.19
Av. final Wt. per animal (pounds)	190	163.7	156.2	156.2	201.45	165.04	195.6	195.6	195.90	164.45	177.55	177.55
Av. daily gain per animal (pounds)	1.75	1.37	1.09	1.09	1.77	1.28	1.69	1.69	1.76	1.33	1.50	1.50
Concentrates required per 100 pounds gain:												
Corn (pounds)	322.5	293.13	385.03	385.03	358.55	243.87	375.41	375.41	341.24	274.01	392.12	392.12
Tankage (pounds)	19.2	27.55	27.73	27.73	19.7	19.72	26.36	26.36	19.83	24.66	27.70	27.70
Total	341.7	300.68	412.76	412.76	378.25	263.59	401.77	401.77	361.07	298.67	419.82	419.82

Reference: Bulletin 233, Auburn, Alabama.

*Lot 2 Received corn 10, Tankage 1 the first year; Corn 12, Tankage 1 on second, third and fourth years.

METHOD OF PROCEDURE

TIME AND DURATION OF TRIAL—The plan called for placing pigs on green forage at the earliest date in the late winter or early spring that sufficient pasture was available. The dry lot group was to be started simultaneously with the grazing groups. The experiment was to close at the time the majority of the pigs had reached the stage of growth and fattening required of a top hog on the Montgomery market, which was from 175 to 200 pounds in weight.

ANIMALS—Pigs farrowed in the fall were used for each of the experiments. The animals were purebred Poland China, purebred Duroc-Jersey, and Poland China-Berkshire cross. The average age and weight varied each year according to the time pigs could be placed on experiment, which in turn depended upon the growth made by the pasture crops. All pigs were kept under similar conditions prior to being placed on experiment. During the period between weaning and the beginning of the experiment the pigs were placed in a dry lot and fed a ration of white corn 8 parts, wheat shorts 4 parts, and digester tankage 1 part, by weight. (There are two kinds of tankage, digester tankage and stick tankage. Digester tankage is the ground rejected carcasses. Stick tankage is the ground carcasses including the blood. The protein in blood is largely indigestible. Therefore the digester tankage has a higher value per pound of protein.) For each trial the animals were divided into three lots as nearly uniform as possible with reference to breed, sex, weight, conformation, and condition.

FEEDS AND METHOD OF FEEDING—The ration used in the different lots were:

Lot 1—White corn and tankage, self-fed, free-choice on pasture. (Self-fed means that the feed was kept before the hogs at all times. Free choice means that the feeds were self-fed separately. In other words the hog could eat as much of each as he chooses.)

Lot 2—White corn and tankage, hand-fed at the rate of 3 per cent of live weight (in two feeds daily.) The proportion of corn to tankage fed was 10 to 1 the first year and 12 to 1 the second, third, and fourth years.

Lot 3—White corn and tankage, self-fed, free-choice in dry lot. A mineral mixture composed of equal parts, by weight, of charcoal, bone meal, and salt was supplied to all lots in a self-feeder. Hydrant water was kept before the animals at all times. The pasture lots consisted of one acre. The dry lot was 20 by 60 feet. Oats and vetch were used as grazing crops in 1926 and 1927, and oats and Austrian Peas in 1928 and 1929.

WEIGHINGS—At the beginning and at the end of each experiment weights were taken on three consecutive days, the averages of which were recorded as the initial and final weights, respectively. Weights of individual animals were taken at intervals of 14 days; these weighings served for keeping the ration adjusted to 3 per cent of the live weight in Lot 2.

RESULTS OF FIRST EXPERIMENT—The oats and vetch were ready for grazing March 1, and the experiment was started on that date. The 29 pigs used in this experiment averaged 80 pounds each when the test started. There was an abundance of grazing available in the grazed lots at all times. The experiment covered a period of 56 days.

RESULTS OF SECOND EXPERIMENT—The season was somewhat earlier in 1927 than in 1926 and the oats and vetch were ready for grazing on February 18. The pigs used this year averaged only 56 pounds each when placed on experiment. There were 10 pigs in each lot when the experiment was started, however, one pig in lot 1, two pigs in lot 2 and two pigs in lot 3 proved to be unthrifty and were removed from the experiment after about two weeks. The experiment covered a period of 84 days.

There was an abundance of grazing at all times in the grazing lots, and a considerable amount of green material was turned under after the experiment closed.

RESULTS OF THE THIRD EXPERIMENT—In the third experiment oats and Austrian peas were used as a grazing crop instead of oats and vetch. The experiment was started March 1. The pigs averaged a little more than 100 pounds each.

at the beginning of the test. The one-acre plots furnished an abundance of grazing for 10 pigs in each lot and as in the two previous experiments, a considerable amount of green material was turned under after the test closed.

RESULTS OF FOURTH EXPERIMENT—Oats and Austrian peas were again used as the pasture crop in the fourth experiment. They were large enough to graze by February 1, which was from two to four weeks earlier than usual. The pigs in this experiment averaged a little above 50 pounds each at the beginning of the experiment. One pig in lot 2 died during the experiment and the necessary adjustments were made in calculating the results. The one-acre plots again furnished sufficient grazing for the 10 pigs on each and a considerable amount of green material was turned under after the experiment closed.

Checked and approved by J. C. Grimes, Alabama Experiment Station, Auburn, Alabama.

The following is a one-year test run at the Central Station, State College, Mississippi—1904.

TABLE 19—VALUE OF GRAZING SPRING VETCH BY DAIRY COWS

Lot No.	FEED PER DAY		PASTURE		MILK PRODUCTION	
	For 4 weeks: prior to beginning of test	During Test (4 weeks)	For 4 weeks: prior to beginning of test	During Test (4 weeks)	For 4 weeks: prior to beginning of test	During Test (4 weeks)
1 (4 Cows)	*J. G. Hay 10 lbs. **C. S. Hulls 10 lbs. **C. S. Meal 4 lbs. Wheat Bran 6 lbs.	*C. S. Hulls 10 lbs. **C. S. Meal 4 lbs.	Hulls Typical Native Pasture	Hairy Vetch ($\frac{3}{4}$ acre per cow)	1636 lbs.	1800 lbs.
2 (4 Cows)	*J. G. Hay 10 lbs. **C. S. Hulls 10 lbs. **C. S. Meal 4 lbs. Wheat Bran 6 lbs.	*J. G. Hay 10 lbs. **C. S. Hulls 10 lbs. **C. S. Meal 4 lbs. Wheat Bran 6 lbs.	Typical Native Pasture	Typical Native Pasture	1710	1528

*Johnson grass.

**Cottonseed.

Reference: Mississippi Agricultural Experiment Station Report—1904, pages 21, 22. State College, Miss.

The cows of Lot No. 1 were turned in on vetch pasture on March 20 and grazed there daily until April 16. Grazing, seemingly, did not decrease the yield of vetch seed. The native pasture at this season was furnishing but little grazing, yet the pasture used was representative of the pastures found on the average farm where no preparations are made for spring pasture. Professor Moore, head of the Dairy Department, says, "It was little more than an exercise lot." The following additional information is given by Professor Moore from his recollections of the experiment: "The cows were grazed only in the day time, but were grazed every day during the four weeks of the experiment."

Rate of Seeding—30 pounds per acre.

Date of seeding—Very probably in September or October.

Method of planting—Land was flat broken and disked, seed were sown broadcast and harrowed in with spike-tooth harrow.

There was very probably no crop planted in the summer prior to the planting of vetch, but if there was, no fertilizer nor manure was applied either to the crop or to the vetch."

Soil Type—Houston clay—To an average of about eight inches consists of a dark-gray to nearly black clay, crumbly when moist and exceedingly sticky and plastic when wet, underlain by a plastic and adhesive clay or silty clay. The latter is uniformly lighter color than the soil, becoming drab or gray at about 30 inches.

At depths ranging from 4 to 8 feet is found the partly decomposed grayish rock from which the soil material is derived.

The granular structure of the dry soil is due to a high content of lime. Small lime balls and occasional fragments of the original rocks are present in the surface soil and subsoil.

The Houston clay locally known as "black prairie" is derived from the underlying soft, impure, bluish limestone which is geologically known as the "selma chalk."—(Dr. Dorman, Agronomy Department, Mississippi Experiment Station.)

In terms of production—15 to 20 bushels of corn or one-third bale of cotton without fertilizer. This was the first year that vetch was grown on this land.

F. VALUE AS HAY CROP

Are winter legumes satisfactory hay crops? How do the yields compare with other hay crops? How does the feeding value per ton compare with that of other hay crops?

AUSTRIAN WINTER PEAS AS HAY CROP—

The Austrian Winter Field Pea is a heavy yielder of hay, either when seeded alone or with a small grain. The quality and feeding value is considered about equal to good vetch hay. The yield is usually considered to be about 10 percent higher than for vetch.

The stems are quite soft, leaves are abundant, and the hay material, when properly handled and cured, is a light green color. Livestock of all kinds consume it very readily and feeders claim that they obtain as good results feeding pea hay as with other good legume hays—(Agricultural Experiment Station Bulletin 286, page 15, Corvallis, Oregon.)

VETCH AS A HAY CROP—

Vetch alone or vetch with a companion crop, preferably oats, is considered by livestock men to be among the best of the legume or legume and grain hays. The hay, if properly handled and cured, is of a bright color, leafy, comparatively fine stemmed, and is high in nutrition and palatability. All kinds of livestock do well on it and will consume large quantities.—(Station Bulletin 213, Corvallis, Oregon, page 17.)

TABLE 20—GREEN WEIGHTS OF COVER CROPS IN COTTON AND CORN
GREEN MANURE TESTS FOR NINE YEARS—TIFTON, GEORGIA

Crop	1926	1927	1928	1929	1930	1931	1932	1933†	1934	Av.
Cut March 1st										
Aus. Winter Peas	22215	21780	20908	7880	3380	6270	3565	5990	6440	10936
Abruzzi Rye	8929	10454	8603	3580	2000	5860	610**	4140	3600	5308
Hairy Vetch	9583	8712	8820	2960	7040*	6880	8450	12214	4200	7651
Monantha Vetch	21345	20038	27718	9180	13140	13470	13060	8345	8860	15017
Cut March 15th										
Aus. Winter Peas	21017	25265	19166	9360	11620	7790	1820	8570	13340	13105
Abruzzi Rye	10672	9162	7514	10730	2530	10030	770**	8150	3640	7022
Hairy Vetch	7395	9020	9256	5080	18910*	8740	10980	17730	7240	10483
Monantha Vetch	17380	26412	24493	14380	18130	19680	10800	15040	14540	17872

Reference: Georgia Coastal Plain Experiment Station Bulletin 21, page 42, Tifton, Georgia.

†Seedings made this year November 25, other years about October 15.

*Seed for this planting proved to be the smooth type Hairy vetch.

**This proved to be Rosen rye instead of Abruzzi.

Soil type—Tifton Sandy Loam as described in Table 3.

The same two acres are used every year for this test. Cotton and corn as reported in Tables 3 and 14 are alternated each year. Cuttings are made on land following these corn and cotton plots. No fertilizer was applied to the cover crops, but corn and cotton preceding, received the fertilizer as designated in the footnotes of Tables 3 and 14.

Other conditions as in Table 3.

Checked and approved by J. C. Walters, Georgia Coastal Plain Experiment Station, Tifton, Georgia.

TABLE 21—DIGESTIBLE NUTRIENTS AND FERTILIZING CONSTITUENTS
IN CERTAIN HAY CROPS (DRY)

Kind of hay	Total dry Matter in 100 lbs.	Digestible Nutrients in 100 lbs				Nutritive Ratio 1:	Fertilizer constituents in 1000 pounds		
		Crude Protein	Carbohy- drates	Fat	Total		Nitro- gen	Phos- phorus	Pot- ash
Hairy Vetch	87.7	15.7	37.1	1.9	57.1	2.6	31.8	10.3	26.2
Vetch and Oats	84.3	6.9	37.0	1.4	47.1	5.8	17.0	6.0	12.7
*Peas and Oats	83.4	8.3	37.1	1.5	48.8	4.9	18.2	6.6	16.4
Bur Clover	93.0	15.6	42.8	0.2	58.8	2.8	30.7	.....	.....
Cowpeas, before bloom	92.2	17.8	27.0	1.0	47.0	1.6	41.9	.....	.....
Cowpeas in bloom to early pod	89.4	12.6	34.6	1.3	50.1	3.0	29.6	.....	.....
Cowpeas ripe	90.0	6.9	42.1	1.0	51.2	6.4	16.2	.....	.....
Soybean hay	91.4	11.7	39.2	1.2	53.6	3.6	25.6	6.8	23.3
Sudan grass	88.4	3.7	45.7	0.9	51.4	12.9	13.1	.....	.....
Johnson grass	89.9	2.9	45.0	1.0	50.1	16.3	10.6	4.2	11.3
Crab grass	90.5	3.5	40.0	1.0	45.7	12.1	12.8	9.0	30.9
Crimson clover	89.4	9.7	36.8	1.0	48.7	4.0	22.6	6.1	22.4
Kudzu vine	93.3	12.4	37.7	1.1	52.6	3.2	29.3	6.2	.....
Lespedeza or Japan clover	88.2	8.6	41.1	1.1	52.2	5.1	19.4	10.3	20.7
*Field Pea	88.9	12.2	40.1	1.9	56.6	3.6	24.2	6.7	12.4

Reference: Feeds and Feeding, Henry and Morrison. (Revised.)

*The field peas grown in the northern states are usually a type called "Canadian field peas." I understand that Austrian winter peas are quite similar, and I presume the composition would be about the same.—(Extract from letter from F. B. Morrison, co-author of Feeds and Feeding.)

II. DETERMINING WHAT COVER CROP TO GROW

Which cover crop produces the largest increased yields in the succeeding crop? Which winter legumes are better adapted for hay? For grazing?

A. COMPARATIVE YIELDS OF SUCCEEDING CROPS.

There is an excellent four year test of the effect of Austrian Winter Peas, Monantha Vetch, Hairy Vetch, and Hungarian Vetch on the yields of cotton on page 13, Circular 51, South Carolina, "Winter Cover Crop Experiments at the Pee Dee Experiment Station," but the conditions under which this experiment was run have not been obtained, and it is omitted from this publication. This is a comparative test of the legumes with 200 pounds nitrate of soda per acre, and without nitrate of soda.

Consult also Table 3. With how many winter legumes did the additional nitrogen pay? In how many cases did the cover crop make as much as both the cover crop and nitrogen? Which cover

crop made the highest yield without nitrogen? With nitrogen?
 See Table 14. Apply same questions as above.
 See also Table 15.

B. COMPARATIVE VALUE AS HAY

TABLE 22—VARIETY TEST WINTER PEAS AND VETCHES

Variety	Yield in Pounds Green Weight per Acre					Average
	1929	1930	1931	1932	1933	
Austrian Winter Peas	7,819	4,320	2,560	1,080	6,960	4548
Chang Winter Peas	6,080	1,240	3,379	.....	.....	3566 (3 yrs.)
Monantha Vetch	11,179	7,040	5,739	4,221	17,320	9100
Smooth Vetch	10,960	3,160	3,680	2,819	.....	5155 (4 yrs.)
Hairy Vetch	7,139	4,080	3,019	2,240	12,720	5840
Purple Vetch	5,059	80	2,960	1,581	2,840	2504
Hungarian Vetch	7,600	5,480	2,419	880	5,360	4348

Reference: Georgia Coastal Plain Experiment Station, Bulletin 21, page 45, Tifton, Georgia.

Seeded about October 15. Cut March 15.

No fertilizer applied to cover crop, nor had any been applied to the land for the last two years before cuttings were made.

Soil type and other conditions same as given in Table 3.

This test was not planted in the fall of 1933. Therefore, no weights for 1934.

Checked and approved by J. C. Walters, Georgia Coastal Plain Experiment Station, Tifton, Georgia.

See Section I. F. for further comparison of values as hay.

C. COMPARATIVE GRAZING QUALITIES

See Section I. E. for comparison of grazing qualities.

III. INOCULATING SEED

Does it pay to inoculate winter legume seed?

The experiment in Table 23 was conducted at the Alabama Agricultural Experiment Station, Auburn, Alabama. All plots were fertilized alike with acid phosphate and sulphate of potash. Before sowing, one lot of seed was dipped into water into which there had been stirred and allowed to settle earth from a lawn where common vetch had made a luxuriant growth for several years. The seed of hairy vetch were sown on plots October 17, 1896.

The plants from inoculated seed formed numerous branches which were about 3 feet long. The plants from the ordinary untreated seed formed only a few short branches.

TABLE 23—THE EFFECT OF INOCULATION ON YIELDS AND RETURNS FROM HAIRY VETCH

Treatment of seed	Yields per acre pounds of hay	Increased yield per acre in pounds of hay
Not inoculated	232	.....
Inoculated	2540	2308

The experiment in Table 24 was conducted at the Alabama Agricultural Experiment Station, Auburn, Alabama. The soil was uniform in fertility. The seed of hairy vetch was sown on one-twelfth of an acre plots, November 4, 1897, at the rate of 30 quarts to the acre. On some of the plots the seed were sown without inoculation. On the other plots the seed were dipped in a solution of vetch "Nitragin." The crop was cut for hay May 9, 1898.

**TABLE 24—THE EFFECT OF INOCULATION ON YIELDS AND RETURNS
FROM HAIRY VETCH**

Treatment of seed	Yield per acre in pounds of hay	Increased yield per acre in pounds of hay
Not inoculated	564	.....
Inoculated	3270	2706

Reference: Agricultural Education, Clemson College, South Carolina, Vol. IV. Nos. 11 and 12, June and July, 1928, pages 130-131.

IV. PLANTING

A. TIME

At what time should winter legumes be planted in this section for best results?

TABLE 25—DATES OF SEEDING WINTER COVER CROPS AT TIFTON, GA.

Cover Crop	Date	Yield in Pounds Green Weight per Acre						Average
		1928	1929	1930	1931	1932	1933	
Austrian Winter Peas—Oct. 1		13,510	.....	9,000	9,480	680	4520	*7438
Austrian Winter Peas—Oct. 15		13,120	7,979	7,680	6,859	880	3979	6749
Austrian Winter Peas—Nov. 1		9,840	4,960	3,000	4,840	680	2440	4293
Austrian Winter Peas—Nov. 15		4,550	1,899	1,240	1,720	232	1080	1787
Austrian Winter Peas—Dec. 1		1,890	480	520	499	130	840	726
Monantha Vetch—Oct. 1		7,440	.....	20,640	11,019	7,100	9160	*11,072
Monantha Vetch—Oct. 15		8,880	7,139	21,160	7,240	5,080	10280	9,963
Monantha Vetch—Nov. 1		8,100	8,000	11,640	7,040	5,200	4899	7,479
Monantha Vetch—Nov. 15		2,605	6,080	3,200	2,600	2,480	2339	3,217
Monantha Vetch—Dec. 1		1,135	1,699	720	699	530	560	890
Hairy Vetch—Oct. 1		4,320	.....	18,880	10,200	7,520	8139	*9,812
Hairy Vetch—Oct. 15		6,020	2,739	21,240	6,720	5,000	6080	7,966
Hairy Vetch—Nov. 1		3,860	2,520	5,320	4,040	2,440	3779	3,659
Hairy Vetch—Nov. 15		1,190	2,680	3,160	1,640	1,640	1920	2,038
Hairy Vetch—Dec. 1		360	800	1,160	320	1,840	1200	947

Reference: Georgia Coastal Plain Experiment Station Bulletin 21, page 47, Tifton, Georgia.

Cut March 15. *Five year average.

Seeding rates—Austrian Winter Peas, 40-50 pounds per acre; Monantha vetch, 35 pounds; Hairy vetch 30 pounds.

Soil type and other conditions same as in Table 3.

No plantings were made in the fall of 1933. Thus, no results for 1934.

Checked and approved by J. C. Walters, Georgia Coastal Plain Experiment Station, Tifton, Georgia.

**TABLE 26—POUNDS OF GREEN MATERIAL PER ACRE ON THE TIME
AND RATE OF SEEDING EXPERIMENT OF HAIRY VETCH, MONANTHA
VETCH, AND AUSTRIAN WINTER PEAS AT AUBURN, ALABAMA**

HAIRY VETCH		MONANTHA VETCH		AUSTRIAN WINTER PEAS	
Seeding rate Pounds	Yield per acre Pounds	Seeding rate, Pounds	Yield per acre Pounds	Seeding rate Pounds	Yield per acre Pounds
Planted September 30					
10	1,027	10	8,393	30	7,412
20	1,577	20	9,240	45	8,138
30	2,228	30	9,211	60	8,653
Planted October 26					
10	791	10	5,308	30	4,747
20	1,682	20	6,949	45	5,668
30	1,893	30	7,700	60	6,931

Tabl 26 (Cont'd.)

Planted November 23

10	354	10	1,442	30	2,313
20	676	20	2,000	45	3,322
30	918	30	2,930	60	3,669

Planted December 19

10	None	10	594	30	835
20	None	20	947	45	1,393
30	None	30	1,312	60	1,562

Reference: Alabama Agricultural Experiment Station Bulletin No. 232, page 29, Auburn, Alabama.

Fertilizer applied to cover crops—600 pounds 16% basic slag planted in drill with seed.

Date of cutting cover crop—About April 1.

Soil type—Norfolk sandy loam. For description see Table 10.

Number of years that land on which test was run has been in cultivation—At least 22 years.

Has test been run continuously on the same land? Yes.

Width of rows—12 inches. Cover crop plots not grazed. Size of plot 1-453 acre.

Drill opened with garden plow. Basic slag and seed put in row together and covered with gee whiz.

Practically the same results were secured year in and year out and the experiment was discontinued in 1929 on this account.

Checked by E. L. Mayton, Agricultural Experiment Station, Auburn, Alabama.

B. RATE

What rate of seeding each legume gives the highest yield of green weight per pound of seed?

TABLE 27—RATES OF SEEDING WINTER COVER CROPS AT TIFTON, GA.

			Yield in Pounds Green Weight per Acre						
Cover Crop	Rate, Pounds		1928	1929	1930	1931	1932	1933	Av.
Austrian Winter Peas	20	2,595	5,179	3,640	5,739	1,219	7080	4242	
Austrian Winter Peas	30	3,675	3,659	6,560	6,600	1,981	8680	5192	
Austrian Winter Peas	40	3,700	2,520	7,080	8,579	2,040	8640	5426	
Austrian Winter Peas	50	4,810	2,000	8,280	8,960	2,680	5779	5418	
Austrian Winter Peas	60	5,830	2,339	8,040	9,099	3,059	6120	5748	
Monantha Vetch	20	1,445	10,040	3,520	8,099	5,600	7440	6024	
Monantha Vetch	25	2,280	11,440	2,800	6,520	5,880	8520	6240	
Monantha Vetch	30	2,030	8,080	4,840	7,360	7,000	8819	6355	
Monantha Vetch	35	1,840	8,640	3,960	9,840	4,800	10240	6553	
Monantha Vetch	40	3,020	8,640	3,840	10,160	6,240	9960	6976	
Hairy Vetch	15	940	3,280	8,440	6,200	6,960	5560	5230	
Hairy Vetch	20	1,040	2,960	9,920	3,680	7,200	5840	5107	
Hairy Vetch	25	1,975	3,080	7,040	4,259	7,200	6760	5052	
Hairy Vetch	30	1,705	3,560	8,200	3,539	7,480	6840	5220	
Hairy Vetch	35	1,675	4,400	10,840	4,320	8,480	7400	6186	

Reference: Georgia Coastal Plain Experiment Station Bulletin 21, page, 46, Tifton, Georgia.

Planted about October 15. Cut March 15.

Soil type same as in Table 3.

No plantings were made in the fall of 1933. Thus, no results for 1934.

Method of seeding and other conditions as given in Table 3.

Checked and approved by J. C. Walters, Georgia Coastal Plain Experiment Station, Tifton, Georgia.

See also Table 26 for rates of seeding experiment.

C. METHODS

What method of seeding proves most profitable? Has a comparative experiment been made with the method of seeding that is most common in Mississippi? How does the labor required for the various methods compare?

**TABLE 28—POUNDS OF GREEN MATERIAL PER ACRE ON THE METHODS
OF SEEDING EXPERIMENT OF HAIRY VETCH, MONANTHA VETCH,
AND AUSTRIAN WINTER PEAS 1927-1929 AT
AUBURN, ALABAMA**

Date of Planting	Broadcast			Three Year Average 1927-29 Drilled		
	Hairy Vetch	Monantha Vetch	Austrian Winter Peas	Hairy Vetch	Monantha Vetch	Austrian Winter Peas
September 30	2,393	8,613	5,186	3,100	10,492	6,906
October 26	1,109	5,428	3,455	1,966	5,912	5,061
November 23	442	1,890	1,928	852	3,063	3,216
December 19	113	347	651	210	903	1,283

Reference: Alabama Experiment Station Bulletin 232, page 28, Table 12, Auburn, Alabama.

Fertilizer applied to cover crop? 600 pounds 16% basic slag, drilled or broadcast with seed.

Seeding rates of cover crop? Austrian winter peas, 45 pounds per acre, Monantha vetch, 20 pounds, Hairy vetch, 20 pounds.

Date of cutting cover crop? April 1.

Soil type. Norfolk sandy loam. For description, see Table 10.

Number of years that land on which test was run has been in cultivation? At least 22 years.

Has test been run continuously on the same land? Yes.

Drilled rows—12 inches apart. Plots not grazed. Size 1-453 acre.

Drill opened with garden plow. Fertilizer (Basic Slag) and seed put in together and covered with gee whizz.

Due to the fact that practically the same results were secured year in and year out, the test was discontinued in 1929.

Checked by E. L. Mayton, Alabama Experiment Station, Auburn, Alabama.

**TABLE 29—METHODS OF SEEDING WINTER COVER CROPS
AT TIFTON, GEORGIA**

Methods of Seeding	Yield in Pounds Green Weight per Acre					
	1929	1930	1931	1932	1933	Average
Austrian Winter Peas:						
Seeded with grain drill	6,200	3,160	5,080	1,000	3,960	3,880
Broadcast, covered with disc harrow	6,379	3,000	3,859	1,040	6,040	4,063
Broadcast, covered with one-horse turn plow	7,320	5,640	6,019	1,699	6,800	5,495
Broadcast, covered with section harrow	5,339	2,800	3,560	1,480	5,240	3,684
Seeded in 18 inch rows	6,920	3,880	3,779	1,480	5,520	4,316
Monantha Vetch:						
Seeded with grain drill	5,680	5,840	8,619	6,800	15,560	8,500
Broadcast, covered with disc harrow	4,259	5,680	4,925	5,160	10,960	6,197
Broadcast, covered with one-horse turn plow	4,720	7,400	6,779	5,021	13,240	7,432
Broadcast, covered with section harrow	3,680	2,800	3,299	3,040	13,320	5,228
Seeded in 18 inch rows	3,520	3,400	4,280	4,880	12,720	5,760
Hairy Vetch:						
Seeded with grain drill	2,960	7,720	3,360	7,680	9,120	6,168
Broadcast, covered with disc harrow	3,019	4,960	2,299	7,400	8,080	5,151
Broadcast, covered with one-horse turn plow	1,200	7,840	3,659	8,120	7,400	5,644
Broadcast, covered with section harrow	680	3,080	2,040	6,360	8,520	4,136
Seeded in 18 inch rows	2,979	5,960	2,240	7,640	6,960	5,156

Reference: Georgia Coastal Plain Experiment Station Bulletin 21, page 49, Tifton, Georgia.

Seeded: About October 15. Cut March 15.

No fertilizer applied for 2 years prior to time green weights were taken.

The method of seeding with grain drill is described in detail in Table 3.

No plantings were made in the fall of 1933. Thus, no results for 1934.

Checked and approved by J. C. Walters, Georgia Coastal Plain Experiment Station, Tifton, Georgia.

V. GRAZING

Common vetch is eagerly eaten by all farm livestock. As a general rule, the vetch is pastured only when the ground is dry, not only to avoid packing the soil but because both cattle and sheep are liable to bloat on vetch, especially in wet weather.

Even when vetch is grown primarily for hay or for seed a limited amount of pasturing is often desirable, especially where the growth is unusually rank or where it is desirable to make the harvest later. Hogs should not be used for this purpose, as they kill out many of the plants by biting them off below the crown. Sheep and calves do the least damage in pasturing vetch designed for a hay or seed crop.—(Farmers' Bulletin 515, page 7.)

FALL AND WINTER GRAZING. The crop should not be grazed until the plants are four to six inches high. Grazing when the land is wet will injure both the crop and the soil, but a reasonable amount of grazing when the land is dry does not injure either. When this practice is followed the crops may be grazed up to March 10th without materially reducing the yield of hay or grain.—(From News Letter issued by Professor J. S. Moore, State College, Miss.)

See Section I. E. and I. F. for information on green weight per acre and value of cover crops as grazing.

VI. SAVING SEED

IS IT PRACTICAL TO SAVE SEED OF WINTER LEGUMES IN THE SOUTH?

The production of Austrian winter pea seed and vetch seed is irregular and uncertain, and yields are small even when obtained. Corn ear worms sometimes attack hairy and smooth vetch and defoliate them, but in Rowan County, N. C., seed of smooth vetch has been grown for the market for several years. Further south there is more danger from the worms. If one chooses to make the attempt, however, he had better watch for the worms every day after pods begin to form, and at the first sign of them he can plow down the crop as a fertilizer. If the worms do not appear he can keep the crop for seed.

Winter peas and the aforementioned vetches are harvested for seed in the South by raking the vines when they are ripe or dead ripe. At this time the vines break off at the ground. They can then be threshed or knocked out with a flail. Shattering is greater with hairy and smooth vetch than with Austrian winter peas and Monantha vetch.—(Farmers' Bulletin 1663, page 10.)

HARVESTING FOR SEED—

Common vetch seed is produced in large quantities in the United States only in the Willamette Valley, Oregon. The methods of handling the seed crop vary, due partly to differences of opinion as the best method, but more largely to the machinery available to the grower.

It is the general practice to cut vetch for seed as soon as the lower pods are fully ripe, at which time the upper pods will be

fully formed and the plant will be carrying a maximum quantity of seed. Later cutting occasions more shattering of seed, while earlier cutting results in a considerable percentage of immature seed. In a few places where but little seed is raised, the crop is cut with an ordinary mowing machine. Two men with pitchforks follow the mower and roll the vetch back from the uncut area, so as to enable the machine to get through when cutting the next swath. Sometimes the first swath cut is rolled on the uncut vetch; and when the succeeding swath is cut, the two are rolled back out of the way. This puts the vetch in larger swaths than the first-mentioned and also somewhat reduces the loss from shattering. These two mower and pitchfork methods were formerly used generally, but now have been largely superseded by other methods.

Whatever method is used in cutting, the vetch is put at once into shocks and remains there till threshed. The most important rule in the growing of vetch seed is to handle the crop rapidly and as little as possible when cut.—(Farmers' Bulletin 515, page 5.)

GROWING SEED FOR HOME USE—

Without doubt hairy vetch would be far more extensively employed as a crop if the seed were cheaper. There is little likelihood that European seed will ever reach the farmer at a satisfactory price, but seed can be grown readily in nearly every State in the Union at far less expense than it can be purchased.

At the Mississippi Experiment Station hairy vetch was harvested from the same piece of land five years in succession without resowing, enough seed shattered during harvest to produce a perfect stand. The only treatment has been to plow the land after harvesting the vetch and then sow cowpeas. The cowpeas were cut for hay, after which the vetch quickly made a stand*.

This plan is adapted to all the States south of the Ohio and Potomac Rivers.

Hairy vetch, when cut after some of the seed have matured, if not threshed for seed should be put in a barn with a tight floor as much of the seed will rattle to the bottom. Vetch that is cut so late is not of high feeding value, but the stock will eat much of it and the rest can be used as bedding. In taking out the straw from the mow care should be exercised to shake out any loose seeds it may contain. By this simple method a farmer can easily grow and save his supply of vetch seed at a low cost.—(Farmers' Bulletin 515, page 11.)

On Aug. 10, 1934, Prof. J. S. Moore, Head of the Dairy Department, State College, reported that 1515 pounds of recleaned vetch seed had recently been saved from 7 acres of vetch seeded six years ago. This vetch is followed each year by Johnson grass for hay. The land has not been broken in three years. The seed are threshed with an oat thresher. Mr. Moore thinks that a better stand can be secured with volunteer vetch on unbroken land in hay crop, as the seed are protected from sun by the hay and

*This very probably came from the Holly Springs Station.

are not covered except by hard rains. The vetch being grown on the dairy farm was originally hairy vetch and still has all the characteristics of hairy vetch except that the hairs have disappeared. It seems better adapted to this climate than the original hairy vetch.

SOME HINDRANCES IN SAVING SEED

APHIDS OR PLANT LICE—

Aphids usually attack Austrian Winter Peas in Mississippi before the seed mature. Thus far, no practical means has been found by which aphids may be controlled. The New Jersey Agricultural Experiment Station has found that they may be controlled with 3% nicotine dust applied under a canvas at least 16 feet long at a temperature of 65 to 70 degrees Fahrenheit.

CORN EAR WORM:

Most of the trouble with the earworm on hairy vetch is caused by farmers trying to grow seed. It is a poor policy to attempt to grow hairy vetch seed under Georgia conditions. The yield is small, and the risk is great.—(Bulletin 146, Experiment, Georgia.) For further details see page 15.

ANHRACNOSE AND POWDERY MILDEW as described on pages 16 and 17.

VII. HARVESTING FOR HAY

Vetch should be cut for hay from the period of full bloom to last bloom when the first pods are well developed. It is commonly cut with an ordinary mower with a swather attachment, and the implement does satisfactory work. After cutting, the vetch should be bunched with a horserake and then shocked with pitchforks. This handling should always be done before the vetch leaves are dry. Vetch should be allowed to cure in the shocks several days, and, if possible, hay caps should be used if rainy weather is feared. Where a swather is not used, the harvesting is considerably more difficult. In either case, it is the common practice to allow the vetch to lie one day before shocking.

It is sometimes desirable to pasture fall-sown vetch in the spring, so as to bring the haying season somewhat later and also to prevent heavy lodging. This is quite commonly done in western Washington and Western Oregon.

Common vetch yields from 1½ to 3½ tons of hay to the acre. An average yield in the Pacific States is 2½ tons and in the Southern States somewhat less.—(Farmers' Bulletin 515, page 5.)

The peas should be cut for hay when the seeds in the lower pods are two-thirds developed. At this stage the plants are usually still in bloom and practically all the leaves are green. The forage cures quite rapidly. In order to prevent the powdering and loss of leaves, the cut material should be windrowed when about half cured and allowed to remain in the windrow until ready to haul or shock. It should then be hauled directly or shocked in medium-sized shocks to complete curing. There should be as little handling as possible after curing so as to prevent the loss of leaves.—(Agricultural Experiment Station Bulletin 286, page 15, Corvallis, Oregon.)

VIII. TIME OF TURNING WINTER LEGUMES

When should winter legumes be turned to give the highest yields of succeeding crops? When should the succeeding crop be planted?

TABLE NO. 30—THE EFFECT OF VETCH TURNED UNDER AT DIFFERENT STAGES OF GROWTH ON THE YIELDS OF COTTON

Plot	Legume Nitrate Treatment*	Date of turning Vetch	Date of planting Cotton	(Pounds seed cotton per Acre)										Av. N. Sec. 9 yrs.
				1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	
							North Section							
1	None		April 5	400	376	452	(This plot washed away in 1928)							
2	Nit. Soda		April 5	688	1307	1105	1031	1038						
3	Vetch	Mar. 25	April 5	690	1109	1056	1009	966						
4	Vetch	Apr. 5	April 15	514	1181	939	979	924						
5	None		April 5	364	319	412	233	291						
6	Vetch	Apr. 15	April 25	259	1021	664	1229	993						
7	Nit. Soda		April 25	398	1153	904	1430	1041						
8	None		April 5	417	396	489	312	495						
							South Section (Replication of North Section)							S. Sec. 5 yrs.
1	None		April 5					762						
2	Nit. Soda		April 5					1005						
3	Vetch	Mar. 25	April 5					1020						
4	Vetch	Apr. 5	April 15					660						
5	None		April 5					993						
6	Vetch	Apr. 15	April 25					813						
7	Nit. Soda		April 25					984						
8	None		April 5					735						

Reference: Alabama Bulletin No. 232 Table No. 5, page 18.

*Each plot in the experiment received 600 pounds of superphosphate and 75 pounds of muriate of potash per acre annually. Nitrate of soda was applied to plots 2 and 7 at the rate of 300 pounds per acre. (The early planted cotton has been killed by cold on several years. When the writer visited the station on July 11, 1934, the cotton on the two earlier planted plots did not have as good appearance as that on the latest planted plot, because that on the early planted plots had to be planted over on May 7, 1934. Planting date of cover crops? After the first rain in September,—Never after October 15.

Fertilizer applied to cover crop? None.
Seeding rates of cover crops? 25-30 pounds hairy vetch.
Variety of cotton? Cook Wilt Resistant.
Rotation used. None—Continuous cotton.
Description of soil type. Norfolk sandy loam. For description see Table 10.
Number of years that land on which test was run has been in cultivation? For 22 known years—Don't know how much longer
Has test been run continuously on the same land? Yes.
Width rows—3½ ft. Spacing—2 stalks every 18 inches.
Cover crop plots not grazed. Size of plot—1-30 acre.
Boll weevils poisoned when infestation got above 10 percent.
Checked by E. L. Mayton, Alabama Agricultural Experiment Station, Auburn, Ala.



Photo by Courtesy Alabama Agricultural Experiment Station, Auburn, Alabama, Showing Plots 1 and 2 of Table 9. This is the 34th Consecutive Crop of Corn With and Without Legumes. Photographed June 20, 1929.

TABLE 31—YIELDS OF CORN FOLLOWING VETCH TURNED AT VARIOUS

Plot	Fertilizer Treatment* Pounds per acre	Date turning Vetch	Planting Date	1925**		1926		1927	
				18"	36"	18"	36"	18"	36"
1	None		April 5.....	4.6	5.25	2.3	5.3	3.5	7.82
2	100 lbs. Nitrate of Soda.....		April 5.....	9.96	10.12	17.5	18.4	15.7	13.7
3	200 lbs Nitrate of Soda.....		April 5.....	8.83	8.57	28.1	22.9	22.7	18.0
4	Vetch	Mar. 25	April 5.....	8.36	11.62	26.1	17.9	31.16	23.88
5	None		April 5.....	3.48	6.96	4.7	8.9	7.76	11.02
6	200 lbs Nitrate of Soda		April 20.....	7.6	9.75	31.9	33.2	23.08	21.1
7	300 lbs Nitrate of Soda		April 20.....	7.98	11.3	38.6	37.0	26.94	22.92
8	Vetch	Apr. 5	April 20.....	8.89	12.1	37.3	32.0	33.26	31.82
9	None		April 5.....	3.21	3.48	5.2	7.7	8.82	10.32
10	200 lbs. Nitrate of Soda.....		May 1.....	10.44	8.41	30.8	29.4	23.94	18.32
11	400 lbs Nitrate of Soda		May 1.....	7.5	6.96	35.6	35.7	24.1	20.94
12	Vetch	Apr. 15	May 1.....	4.55	8.3	41.1	37.5	35.18	29.62
13	None		April 15.....	4.28	5.19	7.2	9.0	10.98	12.26

Reference: Bulletin 232, Alabama, Table 4, page 15, Auburn, Alabama.

*All plots received 400 pounds of superphosphate and 50 pounds of muriate of potash per acre in 1925 and 1926. In the fall of 1926, plots 4, 8, and 12 received 1 ton 16% basic slag and 250 pounds of muriate of potash per acre. All other plots received the same fertilizer treatment in the spring of 1927. In the fall of 1931, all plots received 3200 pounds of 10% basic slag and 250 pounds muriate of potash per acre. (Mineral fertilizers now being applied every five years in heavy applications.)

**Yields in 1925 were very low due to drought.

Vetch was killed by cold in January, 1928.

One-fourth of the Nitrate of Soda applied at planting time, three-fourths at knee high.

†All corn in the experiment was severely damaged by larger corn Stalk Borer in 1932 and 1933, so yields for these years cannot be included in the average.

Planting date of cover crops—After first rain in September, never after October 15.

Seeding rates of cover crops—25-30 pounds Hairy Vetch.

Spacing of corn—5 ft. rows, 1 stalk per hill in drill, 18 and 36 inches as shown in table.

Variety of corn—Whatley every year except in 1932. Indian Chief that year.

(They yield about the same.)

STAGES OF GROWTH WITH BOTH 18-INCH AND 36-INCH SPACING

1928		1929		1930		1931		1932†		1933†		7-Yr. Av.	9-Yr. Av.
18"	36"	18"	36"	18"	36"	18"	36"	18"	36"	18"	36"	1925-31	1925-33
4.5	5.9	7.2	8.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
11.7	12.1	14.5	10.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
22.6	14.7	15.1	11.8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
16.0	13.9	31.4	30.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
7.8	8.7	12.3	13.4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
22.0	15.7	26.2	24.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
26.3	16.9	27.2	20.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
28.9	17.6	38.0	31.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
12.1	8.9	11.7	14.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
25.0	21.7	20.6	19.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
36.8	29.0	29.0	19.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
34.6	22.8	32.3	31.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
13.7	7.8	7.2	16.4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

Rotation Used—None—Corn continuously.

Soil Type—Norfolk sandy loam. For description see Table 10.

Number of years that land on which test was run has been in cultivation—Known to have been in cultivation 22 years. Do not know how much longer.

Has test been run continuously on the same land? Yes.

Cover crop plots were not grazed.

Size of plots—1-15 acre.

Budworms attacked corn on vetch plots. No control measures were used.

Austrian Winter peas were run as a cover crop on this test for the first 4 years, but was discontinued on account of Anthracnose. The yield from peas and vetch were about the same. The peas were seeded at 40 to 45 pounds per acre.

Checked and approved by E. L. Mayton, Alabama Agricultural Experiment Station, Auburn, Alabama.

For the average date of turning vetch and planting the following crop by farmers as shown in the study made by the U. S. Bureau of Agricultural Economics, Division of Farm Management and Costs, see footnote Table 3, Section I-A.

CONCLUSION

The growing of winter legumes is a matter for considerable personal study. Not only should the results of the comparative experiments presented in this publication be studied, but a great many other factors should be considered. The comparative prices of commercial fertilizers and winter legume seeds, the comparative risk in the two, the labor available, and the type and number of workstock on the farm are only a few of the factors to be considered in deciding whether or not to grow winter legumes. The primary purpose for which a legume is to be grown is one of the many factors to enter into the decision as to which winter legume to grow. Even in the matter of the number of pounds of seed to be sown per acre, the choice may lie between heavily seeding a few acres or lightly seeding several acres. The sensible decision on this will depend on the number of acres cultivated, the labor, workstock and equipment available and money available for seed.

These decisions will vary according to the locality of the community, the type of farming and the conditions prevailing on the individual farm.



Photo by Courtesy Alabama Agricultural Experiment Station, Auburn, Alabama, Showing Austrian Winter Peas as Recorded in Table 26. September 29 Seeding in Background; November 23 Seeding in Foreground. Photographed April 4, 1926.

APPENDIX

TABLE 32—MINIMUM OFFICIAL TEMPERATURES AT AUBURN, ALA.

Winter of	Lowest Reading		Next Lowest Reading	
	F	Date	F.	Date
1924-25	22.	Dec. 26	24.	Nov. 25
1925-26	9.	Dec. 28	21.	Jan. 14
1926-27	11.	Jan. 16	24.	Dec. 16
1927-28	8.	Jan. 2	13.	Dec. 9
1928-29	24.	Dec. 9	27.	Jan. 12
1929-30	16.	Jan. 19	18.	Dec. 3
do			19.	Dec. 20

Reference: Alabama Agricultural Experiment Station Bulletin 232, page 37.

TABLE 33—RAINFALL AT AUBURN, ALABAMA

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct	Nov	Dec.	Annual
1925	11.9	2.88	1.94	2.11	0.71	0.78	4.39	0.01	5.11	7.69	3.29	3.39	44.2
1926	9.85	4.38	7.0	2.63	1.53	4.18	8.58	4.28	5.0	2.03	3.44	4.59	57.49
1927	0.49	6.06	5.35	1.36	1.67	3.58	5.12	2.86	1.10	0.57	2.97	6.89	38.02
1928	1.80	3.51	4.50	9.35	4.81	8.38	6.39	4.99	5.76	1.59	1.61	2.25	54.94
1929	4.28	9.61	17.47	5.32	7.05	4.19	1.63	1.53	4.55	4.04	6.83	4.74	71.24
1930	4.78	3.05	6.36	3.19	2.84	2.09	4.97	4.56	6.17	2.59	7.14	2.12	49.86
1931	2.91	3.38	2.97	4.95	2.82	0.57	4.63	6.37	0.48	0.95	1.50	8.54	40.07
1932	5.61	4.43	3.45	1.92	2.58	2.43	4.79	4.38	3.21	2.12	6.18	7.14	48.24
1933	2.56	6.58	7.41	2.27	1.33	2.32	3.21	3.49	3.44	4.19	1.1	1.95	39.85

From Monthly Summary of Rainfall and Temperature Records, Weather Bureau, U. S. D. A. By courtesy of Professor J. M. Robinson, Entomology Department, Alabama Poly. Institute.

TABLE 34—MONTHLY, ANNUAL AND AVERAGE PRECIPITATION AND MINIMUM TEMPERATURES AT TIFTON, GEORGIA

	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	Average
January	7.04	5.77	8.76	11.02	.38	1.36	5.11	5.41	2.54	6.06	4.47	5.27
February	1.97	4.43	2.37	4.66	2.93	7.39	4.45	2.56	2.75	2.24	6.14	3.81
March	5.24	4.82	.69	8.30	2.93	5.55	6.19	5.70	2.84	3.50	5.20	4.63
April	1.38	5.41	1.28	3.55	2.58	11.57	3.69	5.96	2.92	1.82	4.44	4.05
May	4.67	1.52	2.88	3.35	.66	3.41	2.34	1.20	3.24	3.68	2.08	2.64
June	8.87	6.50	6.00	2.88	8.40	4.27	7.04	7.22	2.48	3.63	4.33	5.60
July	4.51	5.43	3.34	7.56	6.70	7.93	4.87	5.62	7.11	4.79	9.32	6.11
August	4.14	3.21	1.94	4.20	9.66	18.36	3.29	3.82	4.77	7.51	2.74	5.79
September	1.05	12.01	2.91	2.86	.74	6.72	6.41	3.78	1.56	5.47	3.98	4.32
October	.58	1.01	6.63	1.13	.55	.40	3.31	.23	1.47	5.00	.14	1.86
November	2.01	.26	2.93	4.02	.92	1.11	4.16	2.84	.00	2.81	.78	1.99
December	2.17	6.63	4.65	2.39	7.70	2.48	4.36	3.72	2.73	1.83	1.32	3.63
Yearly												
Total	43.63	57.00	44.38	55.92	44.15	70.55	55.22	48.06	34.41	48.34	44.94	49.70
Minimum Temperature:												
Jan				27°	15	14	24	22	22	30	32	19
Feb.				25°	35	20	28	31	27	33	15	21
Dec.			14°	28°	21	27	18	28	37	34	30	....



Photo by Courtesy Alabama Agricultural Experiment Station, Auburn, Alabama
Showing Vetch Grown on Plot A of Table 10. The Vetch Produced 13,794
Pounds Green Material Per Acre Following Corn. Photographed
and Sampled April 13, 1925.

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A Compilation of
EXPERIMENTAL
And Other
DATA
On

PLANNING THE FEEDING OF FARM ANIMALS

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Jointly Representing
MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
And
MISSISSIPPI STATE VOCATIONAL BOARD

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State College, Mississippi

A Compilation of Experimental and Other Data On

PLANNING THE FEEDING OF FARM ANIMALS

Introduction

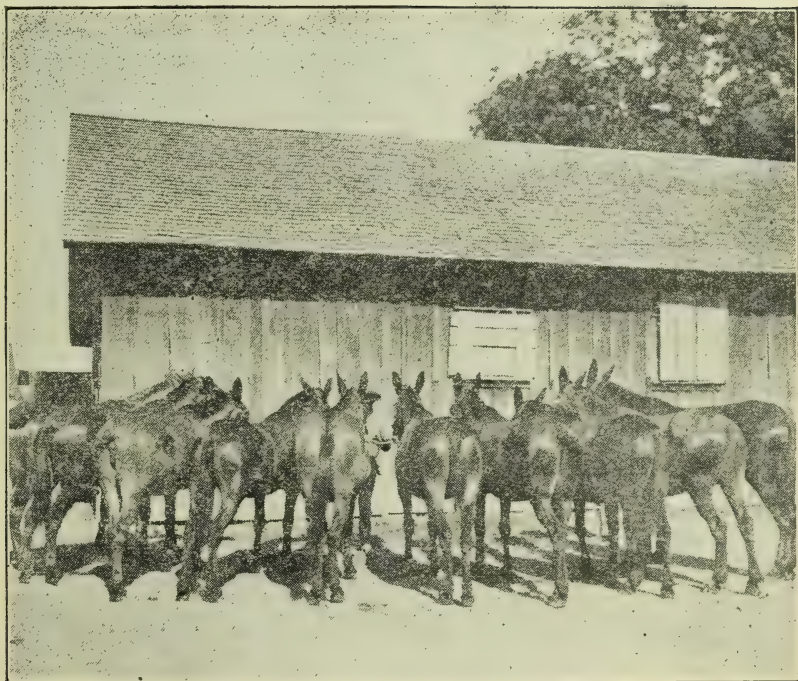
The purpose of this bulletin is (1) to assist in determining the more economical practices to be followed in the feeding of work stock and dairy cattle; (2) to assist in suggesting methods by which the individual farm program may be so planned as to adequately supply the feed required on the farm.

Until recent years a great deal of attention has been given to simply keeping work stock in good condition or to getting high production records with little thought to the economical feeding of animals. It is intended that the economy of feeding livestock be given an important place in this publication. Forms have been provided by which the economy of various feeding methods may be studied.

In compiling this material numerous publications have been examined from various experiment stations of the United States. Many experiments have been found applicable to conditions in Mississippi that could not be included in this bulletin, so we had to select what were thought to be the more important experiments given under a few questions of each section. A complete compilation of all the experimental feeding evidence that is applicable to Mississippi conditions would require much more space than can be used in a single bulletin of this kind. However, it is believed that the more urgent problems are covered in this publication.

PLANNING THE FEEDING OF FARM ANIMALS

SECTION I. PLANNING THE FEEDING OF WORK STOCK



WHAT ARE THE NUTRIENT REQUIREMENTS OF WORKSTOCK?

Table 1—Digestible Crude Protein and T. D. N. Requirements (pounds) per 1000 Pounds Live Weight For Workstock For Each of The Various Work Periods

Work Status	Daily Requirements (Lbs.)		
	Digestible Crude Protein	T. D. N.	
Maintenance (No Work)	0.8-1.0	7.0-9.0	
Maintenance and Work:			
Idle Periods	0.8-1.0	7.0-9.0	
Light Work	1.0-1.2*	9.0-11.0*	
Medium Work	1.2-1.5*	11.0-13.0*	
Heavy Work	1.5-1.8*	13.0-15.0*	

*Requirement for maintenance plus requirement for work.

Reference: Henry and Morrison "Feeds and Feeding," Page 748, Table 5.

DURING HOW MANY DAYS OF EACH YEAR DO WORKSTOCK DO EACH TYPE OF WORK ON MISSISSIPPI FARMS?

This is a question that varies in the various sections of the state, with the various types of farms and with the individual farm from year to year. Below are given some data that may be helpful in determining the number of days worked in each month.

Table 2—Rainfall by Months at Jackson, Mississippi, Average of 5 Years, 1929-33

Averages—1929-33	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
No. Days—No Rain	19.4	15.8	20.0	19.4	20.6	22.4	18.6	21.0	21.2	24.6	18.8	18.6	240.4
No. Days—Less than ½ inch Rain	5.4	6.4	5.2	7.0	5.4	4.8	7.4	7.2	4.0	3.0	4.8	5.6	66.2
No. Days—½ inch or more	4.0	3.6	3.8	1.8	3.0	1.0	8.6	1.6	2.2	2.2	5.2	5.0	37.2
No. Days only trace (Not enough to measure)	2.2	2.4	2.0	1.8	1.8	1.8	1.4	1.2	2.6	1.2	1.0	1.8	21.2
*Total Days Rained	11.6	12.4	11.0	10.6	10.4	7.6	12.4	10.0	8.8	6.4	11.2	12.4	124.8
Average Rainfall per month (1929-1933)	5.24	4.36	5.08	3.23	4.88	1.60	5.87	2.86	3.08	2.85	4.99	6.81	42.4
Av. Per Mo. 1918-31	5.04	4.57	5.84	5.76	4.37	3.56	4.46	3.18	1.75	3.22	4.12	5.72	42.90

*Total of:—No. Days less than ½ inch, ½ inch or more, and only a trace of rain.

Maximum and Minimum Rainfall of Each Type for Individual Months of the Five Years—Jackson, Mississippi

1929-33	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
No Rain	26	20	23	26	24	29	27	28	24	26	21	24
Less than ½ inch	17	7	16	11	16	18	13	19	19	22	16	10
½ inch	9	12	7	10	12	7	10	8	8	5	3	2
1/2 or more	2	3	3	3	4	3	2	6	1	2	3	2
inches	7	5	6	4	4	3	3	3	3	3	10	10
only a trace	3	3	2	0	2	0	2	1	0	0	0	2
Days Rained	5	6	5	5	4	5	4	4	6	4	0	0
	14	21	15	19	15	12	18	12	11	9	14	21
	5	8	8	4	7	1	4	8	6	5	9	7

Reference: Climatological Data—Weather Bureau, U. S. Department of Agriculture, Washington, D. C.

Table 3—Rainfall by Months at Holly Springs, Mississippi, Average of 5 Years, 1929-33

Averages—1929-33	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
No. Days—No Rain	19.4	15.8	20.6	18.2	19.0	23.8	21.0	22.0	23.2	25.2	20.6	19.0	247.8
No. Days—Less than ½ inch Rain	6.0	7.6	5.2	6.6	6.8	4.6	5.2	5.6	3.8	2.8	5.0	6.8	66.0
No. Days ½ inch or more Rain	4.2	4.0	4.4	3.2	3.4	1.0	3.4	2.2	2.4	2.0	3.8	4.6	38.6
No. Days Only a trace (not enough to measure)	1.4	0.8	0.8	2.0	1.8	0.6	2.2	1.2	0.6	1.0	0.6	0.6	17.2
Total Days Rained	11.6	12.4	10.4	11.8	12.0	6.2	10.0	9.0	6.8	5.8	9.4	12.0	117.4
Average Rainfall per Month (1929-1933)	6.18	6.68	6.36	3.81	4.68	1.50	4.86	3.08	3.61	2.98	4.90	7.75	47.0
Av. 14 years 1918-31	4.34	4.03	6.00	5.68	5.15	4.37	3.49	3.09	2.45	3.60	4.84	5.19	43.53

*Total of:—No. Days less than ½ inch, ½ inch or more, and only a trace or rain.

Maximum and Minimum Rainfall of Each Type for Individual Months of the Five Years—Holly Springs, Mississippi

1929-33	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
No. (High)	23	20	32	23	24	37	26	25	28	28	25	23
Less than (Low)	17	13	19	13	15	15	13	20	21	22	16	14
½ inch (High)	8	11	7	11	11	7	8	8	6	5	8	12
½ inch or more (Low)	4	5	3	2	3	2	3	3	1	0	3	2
Only a (High)	7	5	8	6	7	2	9	4	5	3	6	7
Trace (Low)	1	3	2	0	0	0	0	0	1	1	2	2
Days Rained (High)	2	2	2	3	3	1	3	2	2	2	2	2
(Low)	1	0	0	1	1	0	0	0	0	0	0	0
(High)	14	15	12	17	16	9	18	11	9	9	14	17
(Low)	8	8	9	7	7	3	5	6	2	3	5	8

Reference: Climatological Data, Weather Bureau, U. S. Department of Agriculture, Washington, D. C.

Table 4—Rainfall by Months at Poplarville, Mississippi, Average of 5 Years, 1929-33

Averages—1929-33	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
No. Days—No Rain	20.6	16.4	21.0	21.6	23.4	21.6	15.0	17.8	20.0	23.4	21.0	19.6	241.4
No. Days—Less than ½ inch Rain	3.8	4.6	4.2	3.6	3.8	4.4	6.2	7.6	3.4	4.8	3.4	6.8	56.6
No. Days ½ inch or more Rain	4.6	4.2	3.6	2.6	2.6	2.0	5.4	3.4	3.2	1.2	3.6	3.4	39.8
No. Days—Only Trace (Not enough to measure)	2.0	3.0	2.2	2.2	1.2	2.0	4.4	2.2	3.4	1.6	2.0	1.2	27.4
*Total Days Rained	10.4	11.8	10.0	8.4	7.6	8.4	16.0	13.2	10.0	7.6	9.0	11.4	128.8
Av. Rainfall per Month 1929-1933	5.78	6.30	6.01	4.08	6.33	3.30	7.37	6.24	4.10	2.58	5.14	4.62	51.5
Av. 14 years 1918-31	4.56	5.29	5.98	3.79	5.13	5.87	6.14	5.41	3.45	3.25	4.59	5.34	49.00

*Total of:—No. days less than ½ inch, ½ inch or more and only a trace.

Maximum and Minimum Rainfall of Each Type for Individual Months of the Five Years—Poplarville, Mississippi

1929-33	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
No. (High)	24	23	24	25	27	27	20	24	29	24	24	24
Less than (Low)	18	5	19	14	19	18	11	13	14	22	16	14
½ inch (High)	10	12	7	9	8	6	10	11	5	7	6	12
½ inch or more (Low)	1	1	1	1	1	0	2	2	5	2	1	1
Only a (High)	6	6	6	6	4	3	9	7	9	2	6	6
Trace (Low)	2	2	1	1	2	1	2	2	1	0	1	1
Days Rained (High)	4	6	4	3	3	4	8	5	9	3	4	3
(Low)	1	1	0	0	0	0	1	0	1	0	1	0
(High)	13	23	12	16	12	12	20	18	16	9	14	17
(Low)	7	5	7	5	4	1	11	9	6	7	6	7

Reference: Climatological Data, Weather Bureau, U. S. Department of Agriculture, Washington, D. C.

Table 5—Rainfall at State College, Mississippi 4 Year Average, 1922-25

Averages—1922-25	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
No. inches of Rainfall	8.48	5.20	7.56	6.05	5.14	2.73	2.21	3.74	1.57	3.60	3.55	5.10
No. of Rainfalls Exceeding 1 inch per day	3.25	1.75	2.75	2.25	1.50	1.00	0.60	1.50	1.00	1.25	1.50	1.75
No. Days Sprinkled (Not enough to measure)	3.25	2.50	2.75	2.75	3.25	5.00	4.75	3.50	2.00	1.50	2.00	3.75
Total No. Days of Rain and Sprinkled	13.25	10.75	11.00	11.50	11.75	10.50	11.00	8.00	5.00	7.00	6.25	12.50
Total No. Days on which it rained a sufficient amount to measure	10.00	8.25	8.25	8.75	9.25	5.50	6.25	6.25	3.00	5.50	5.75	8.75
Total No. Days of Actual Sunshine	15.50	14.87	18.12	16.62	16.87	20.12	19.0	20.5	21.0	17.75	16.0	16.62
Av. 14 years 1918-31	5.12	3.60	7.02	5.56	4.74	4.22	3.85	3.76	1.93	3.30	4.54	5.32

Both Sundays and Work Days Counted.

Table 6—Number of Days Available For Different Types of Work With a Team (1922-25 Inclusive) at State College, Miss., on What is Now a Part of the Dairy Farm (Week Days Only Counted)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
No. days suitable for out door work	23.0	20.0	22.7	22.5	24.1	25.1	25.4	25.6	24.5	24.7	22.9	20.9	281.4
No. days available for soil work with team (Breaking and Cultivation)	3.7	10.0	8.7	15.7	17.5	19.5	14.5	15.2	9.0	10.5	8.7	11.5	144.5
No. days too wet for satisfactory cultivation of the planted crop	24.2	17.5	18.5	11.2	11.2	4.2	2.5	5.2	2.2	4.2	11.2	17.7	129.8
No. Days Suitable for Breaking of Stubble or other unbroken land	3.5	10.0	8.7	14.2	16.2	11.2	5.7	7.7	6.5	9.0	8.7	6.2	107.42
No. Days too wet for breaking of stubble or other unbroken land	23.2	14.2	18.0	10.2	7.7	2.2	0.7	3.0	1.0	3.5	10.5	18.5	112.7
No. days too wet for breaking or cultivation (With team)	23.2	14.2	18.0	10.2	7.7	2.2	0.7	3.0	1.0	3.5	10.5	18.5	112.7
No. days available for miscellaneous work other than soil (With team)	19.2	10.2	14.0	6.7	6.6	5.6	10.9	10.4	15.5	14.2	14.1	9.4	136.8
No. days too dry for breaking of stubble or other unbroken land	0.0	0.0	0.0	0.0	2.7	12.2	20.0	15.7	18.2	14.3	6.5	1.5	91.0
No. days suitable for satisfactory cultivation of broken land (team)	3.2	6.7	8.2	11.2	14.7	19.2	14.5	14.5	9.0	10.5	8.0	7.2	129.9

Reference: Observations recorded by F. O. Cork, State College Dairy Farm, State College, Mississippi.

It is understood that the above tables can be used only to indicate the number of days during which work can be done. On many days when weather conditions are favorable for field work, there may be no such work to be done. Too, on many days when conditions are unfavorable for field work, other work, such as hauling, may be done. It is expected that the data submitted in the above tables may be helpful in making **estimates** of how many days workstock actually work. The following form should be useful in doing this.

Form 1—Estimating Number Work Days Per Year

Light Work Period						
Type of Work	Nov.	Dec.	Jan.	Feb.	Total	
Heavy - - -						
Medium - - -						
Light - - -						
Idle - - - -						
Heavy Work Period						
Type of Work	Mar	Apr.	May	June	Total	
Heavy - - -						
Medium - - -						
Light - - -						
Idle - - - -						
Medium Work Period						
Type of Work	July	Aug.	Sept.	Oct.	Total	Yearly Total
Heavy - - -						
Medium - - -						
Light - - -						
Idle - - - -						

Form 2—An Illustrative Case For Determining The Digestible Crude Protein and T. D. N. Requirements (Pounds) Per 1000 Lbs. Live Weight, For Workstock For Each of the Various Work Periods

Work Periods	Daily Requirements					Period and Yearly Requirements
	No. Days Per Period	Crude Protein	Total Digestible Nutrients	Crude Protein	Total Digestible Nutrients	
Heavy Work Period						
Work Days	92	1.5-1.8	12.0-15.0	138 - 165.6	1196-1380	
*Idle Days	30	1.0-1.2	9.0-11.0	30 - 36	270- 330	
Total	122			168 -201.6	1466-1710	
Medium Work Period						
Heavy Work Days	35	1.5-1.8	13.0-15.0	52.5- 63.0	455- 525	
Light Work Days	30	1.0-1.2	9.0-11.0	30.0- 36.0	270- 330	
Idle Days	58	0.8-1.0	7.0- 9.0	46.4- 58.0	406- 522	
Total	123			128.9-157	1131-1377	
Light Work Period						
Heavy Work Days	25	1.5-1.8	13.0-15.0	37.5- 45	325- 375	
Light Work Days	40	1.0-1.2	9.0-11.0	40.0- 48	360- 440	
Idle Days	55	0.8-1.0	7.0- 9.0	44.0- 55	385- 495	
Total	120			121 -148	1070-1310	
Grand Total	365			417.9-506.6	3667-4397	
\$Less credit to pasture						
Net Grand Total						

*Idle Requirements used in the heavy work period are 1-3 less than requirements for work days.

†Idle Requirements used in Medium and Light work periods represent maintenance only. While on pasture good enough to maintain body weight without other feed during idle days of the Medium and Light work periods. No allowance need be made for feeding the animal to meet such requirements.

§Therefore deduct whatever requirements that have been calculated on this basis from the grand total.

The above example is to illustrate a method that may be used in finding the approximate total digestible crude protein and total digestible nutrients required for each work period and the total for one year. Each individual will have to work out his own requirements, as the number of days in each period usually will vary with each individual.

Suggestive: How many days are required on your farm for each work period?

How many pounds digestible crude protein and total digestible nutrients are required for 1000 pounds live weight for each period? For the entire year?

How much is required for the entire year for all workstock on the farm?

HOW MUCH GRAIN MAY BE SAVED BY PASTURING MULES AT NIGHT AND ON IDLE DAYS DURING THE WORK PERIOD?

I

During the period from May 4, 1934, to December 4, 1934, an experiment was run at Mississippi Experiment Station in which an effort was made to determine the value of pasture in the feed of working mules. The lots were divided and fed as follows:

Lot 1—Five mules from five teams. Their teammates were put in lot 2. Lot 1 was started out on 1233 pounds ear corn per day per 1000 pounds live weight, which was a 10% reduction over Lot 2 and were given another reduction of 10% on June 1, finally being fed 11.1 lbs. ear corn per day per 1000 pounds. These mules were fed all the Johnson grass hay they would eat, and were turned on pasture every night and on idle days.

Lot 2—Teammates of the five mules in lot 1. They were fed 13.7 pounds of ear corn and 12.0 pounds of Johnson grass hay per day per 1000 pounds of live weight, but kept on dry lot at night and on idle days.

The results of the experiment are discarded from July 10 to September 10, 1934, as two mules from each lot were turned on pasture altogether, while the other three mules of each lot, making three teams, were used to do odd jobs on the experiment station farm, all fed alike, and turned on pasture at night and idle days.

So, the experiment proper covered the period from May 4, to July 10, inclusive, then from September 10 to December 4.

Table 7—Grain, Hay and Pasture vs. Grain, Hay and Dry Lot For Mules at State College, Mississippi

Figures represent pounds average per mule	Lot 1—5 mules. Corn hand fed, Johnson grass hay ad lib. Pasture at night and idle days		Lot 2—5 mules. Corn 13.7 lbs. J. G. hay 12 lbs. Dry lot	
	First Period May 4- July 10	Second Period Sept. 10- Dec. 4	First Period May 4- July 10	Second Period Sept. 10- Dec. 4
Initial weight	1169	1185	1279	1266
Final Weight	1216	1293	1219	1312
Gain	47	31	20	18
Ear Corn Consumed	4206	5596	5136	7080
Johnson Grass hay consumed	1510	3490	5055	5566
Days covered by the experiment	68	86	63	86
No. idle days during experiment	47	19	52	29.4

Weighings were made each week. At the beginning and at the close of the test, weighings were made on three consecutive days and the average of these was used.

Method of Feeding—The mules of lot 1 were fed together in a large stall while those in lot 2 were fed in individual stalls. Enough corn for the five mules of lot 1 was put in a trough to which all mules had access. Corn was fed in two equal portions at morning and night. All hay was fed at night. On idle days, the night feed of corn was cut in half in each lot, but the amount of hay was the same as on work days.

Grades of Feed—No. 1 Johnson Grass hay and No. 1 Mosby corn were fed to both lots.

Ability to Work—The pastured lot sweat more freely, and seemed to withstand the heat better and generally to stand up under work a little better than the mules on dry lot.

Pasture—Until June 1st the mixture was made up of 80% Yellow Hop Clover, small amounts of Bermuda and Paspalum and a small amount of wild Barley in early spring.

After June 1st, the mixture consisted of Bermuda, Paspalum, Johnson grass and a small amount of sweet clover. The pasture covers about twelve acres, but ten acres of it was about one year old at the beginning of the experiment, estimated to be equivalent to approximately five acres of permanent pasture.

Reference: R. H. Means and H. H. Leveck, Livestock Research Workers, Mississippi Agricultural Experiment Station, State College, Mississippi.

Suggestive—How much corn was saved during the first period by grazing at night and on idle days? In the second period? How much hay was saved in each period?

How did the weights of the mules of lot 2, dry lot, compare on July 11 when they were turned on pasture and September 11 when they were taken off pasture?

How did the weights of the mules of lot 1 compare on these two dates?

Which of the feeding methods is more economical when Form 3, page 20 is applied?

II

An experiment, preliminary to the one reported in Table 7, was run for a period of 181 days at Mississippi State College in 1933, the purpose of which was to find the value of pasture to mules that were self-fed corn and hay. The mules were divided as follows:

Lot 1, 6 mules, teammates to those in lot 2. Fed 13.7 pounds ear corn and 12 pounds Johnson grass hay per 1000 pounds live weight on dry lot, during both work and idle periods.

Lot 2, 6 mules teammates to those in Lot 1. Fed all the shelled corn they would eat from a self feeder, all the Johnson grass hay they would eat and turned on pasture every night and on idle days.

Table 8—Corn and Johnson Grass Hay Hand Fed on Dry Lot vs. Corn and Johnson Grass Hay Free Choice and Pasture at State College, Miss.

	Lot 1	Lot 2
	Ear Corn 13.7 lbs. J. G. Hay, 12 lbs. (Hand fed)	Corn—Self-fed J. G. Hay—Self-fed (Pasture)
Ration per 1000 lbs. mule		
Length of test (days)	181	181
No. of Mules	6	6
Av. initial wt. (lbs.)	1218	1277
Av. final wt. (lbs.)	1229	1366
Av. gain (lbs.)	11	89
Idle days	31	26
Av. daily feed consumed per 1000 lbs. mule:		
Ear corn	12.	11.23**
J. G. Hay	11.7	1.93

**Corn actually fed as shelled corn, but converted to ear corn basis to compare with hand-fed Lot 1.

From July 9 to August 1, only 23 pounds Johnson grass hay was eaten by Lot 2, the mules being pastured. During 20 days of hard work in May, this group consumed only 200 pounds of hay.

The ability of the two lots to stand their work seemed to be about the same. Mosby No. 2 corn, No. 2 Johnson grass hay was fed to both lots.

Reference: R. H. Means, and H. H. Leveck, Livestock Research Workers, State College, Mississippi.

Suggestive—How much ear corn was saved per day by allowing the mules to run on pasture?

How much hay?

How much of each was saved during the 181 days of the test?

According to form 3 suggested on page 20 which of the feeding methods is more economical?

WHAT IS THE COMPARATIVE VALUE OF CORN AND OATS FOR FEEDING WORKSTOCK?

I

The horses used in the experiment reported in Table 9 belonged to the United States Sixth Field Artillery. They averaged about 1165 pounds in weight and ranged in age from five years up, the average age being about eleven years.

Table 9—A Comparison of The Feeding Value of

Lot 1. Oats and Prairie Hay

Lot 2. Corn and Prairie Hay

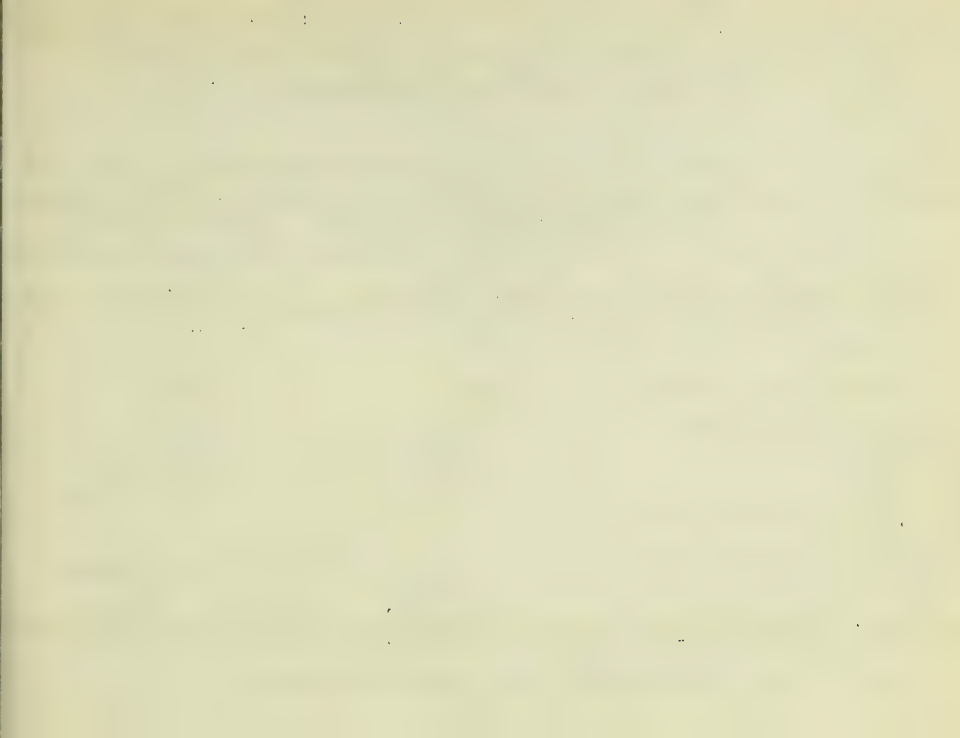
Lot 3. Oats (2-3) Corn (1-3) and Prairie Hay

Lot 5. Oats (1-3) Corn (2-3) and Prairie Hay

Lot 11. Oats and Prairie Hay

Lot No.	Lot 1	Lot 2	Lot 3	Lot 5	Lot 11
No. of Horses	76	76	74	69	18
No. Days Fed	140	140	140	110	140
Av. Intial Wt. (Lbs.) (January 15, 1911)	1131	1181	1185	1197	1182
Av. Final Wt. (Lbs.)	1147	1152	1172	1183	1163
Av. Gain or Loss in Wt. (Lbs.)	+16	-29	-13	-14	-19
Av. Age of Horses	9.35	8.34	10.44	11.0	14.0
Grain Daily per 1000 lbs. Live Wt. (Lbs.):					
Oats	10.5	.....	6.8	3.4	10.3
Corn	.....	10.3	3.4	6.7	.....
Hay Daily per 1000 lbs. Live Wt. (Lbs.)					
Prairie*	12.2	12.0	12.0	12.0	12.0
Digestible Protein per Day, per 1000 lbs. Wt. (Lbs.)	1.5	1.2	1.3	1.2	1.5
T. D. N. per Day, per 1000 lbs. Wt. (Lbs.)	12.6	13.8	12.7	13.1	12.3

*Prairie Hay is wild hay. Its analysis in comparison with other hays is given following Table 12, page 14.



(Correction of Table 8)

Table 8 - Corn and Johnson Grass Hay Hand Fed on Dry Lot vs.
Corn and Johnson Grass Hay Free Choice and Pasture
at State College, Mississippi

	Lot 1	Lot 2
	Ear Corn 13.7 Lbs.	Corn-Self-Fed
Ration per 1000 pound mule	J. G. Hay, 12 Lbs. (Hand Fed)	J.G.Hay -Self-Fed (Pasture)
Length of test (days)	153	153
No. of mules	5	5
Av. initial wt. (lbs.)	1236	1263
Av. final wt. (lbs.)	1247	1324
Av. gain (lbs.)	11	61
Idle days	35	42
Av. daily feed consumed per 1000 lbs. mule:		
Ear corn	12.34	14.38**
J. G. Hay	11.09	2.42

**Corn actually fed as shelled corn, but converted to ear
corn basis to compare with hand-fed Lot 1.

Nature of the Work—Nowhere is the work of horses so uniform as in the army. Each horse does practically the same kind and the same amount of work. The work performed during the experiment in question might properly be classed as rapid light draft. It consisted chiefly of marching and drilling, the horses being hitched to heavy wagons and guns. A considerable portion of the work was done at a trot and no small amount at a gallop. While the artillery horse performing his regular duties did not work so many hours a day as the farm horse during the busy season, yet the work done was extremely fatiguing and more severe than the average work done by the farm horse throughout the year.

Weighing—The horses were weighed individually at the beginning of the experiment and at the end of each thirty-day period. Accurate records were kept of the weights.

Sick Report—A careful sick report was kept. All horses off their feed for more than forty-eight hours, or prevented by illness or injury from performing their regular duties for a like period of time, were eliminated in calculating results.

In the total of 937 horses in 15 lots only fourteen cases of digestive disturbance were observed during the entire period of the experiment. Of these fourteen cases twelve were slight attacks of colic. The other two were severe cases of enteritis, resulting in death.

Digestive disturbances were reported from the following lots:

- Lot 1. One case of colic; mild.
- Lot 2. Three cases of colic; mild.
- Lot 3. One case of colic; mild.
- Lot 5. One case of enteritis; fatal.

Method of Feeding—The horses were fed at 5:30 and 11:30 o'clock in the morning and 5:30 in the afternoon. All lots reported here were fed one-third of the grain allowed at each meal and all of the hay at night. When a ration was of different grains they were thoroughly mixed before feeding.

Corn versus Oats—During the early part of the experiment—January and February—while the weather was cold and the work only moderate, there was apparently no difference between the corn-fed and the oats-fed horses. The horses receiving corn did their work and maintained their weight and condition just as well in every respect as the horses receiving oats. But as the weather grew warmer and the work more severe, the corn-fed horses in lot 2 gradually began to lose weight, and at the end of the experiment had lost 29.3 pounds to the horse.

Reference: Kansas Experiment Circular 62, Pages 2, 3, 4, 12 and 13, Table 6. November 1917, "Feeding Work Horses," Manhattan, Kansas.

Suggestive—How do the various rations compare in their ability to maintain weight?

How do they compare in economy when the form on page 20 is applied?

II

Table 10—Corn vs. Oats at Columbia, Missouri

	1st period (364 days)		2nd. period (364 days)		Average of Both Periods	
	Lot 1	Lot 2	Lot 1	Lot 2		
	(CORN)	(OATS)	(OATS)	(CORN)	(CORN)	(OATS)
Number of Mules	2	2	2	2	4	4
Av. Initial Wt. (Lbs.)	1292.5	1307.5	1265.0	1272.5	1282.5	1286.2
Av. Final Wt. (Lbs.)	1282.5	1277.5	1291.0	1319.5	1301.0	1284.2
Av. Gain or Loss in Wt.	—10	—30	+26	+47	+18.5	—2
Average Corn per Mule per Period (Lbs.)	4304.0			3981.5	4142.7	
Average Oats per Mule per Period (Lbs.)		4423.5	4153.5			4288.5
Average Hay per Mule per period (Lbs.)	5291.6	5516.2	5353.5	5429.0	5360.3	5434.9
Average Grain Fed Daily per 1000 lbs Live Wt. (Lbs.)	9.3	9.6	9.1	8.5	8.9	9.4
Average Hay Fed Daily per 1000 lbs Live Wt. (Lbs.)	11.5	12.0	11.7	11.6	11.5	11.9
DAYS LABOR						
Per Mule:—						
Heavy	46.1	47.1	27.8	40.5	43.3	37.5
Medium	21.6	23.3	14.4	17.8	19.7	18.9
Light	115.7	112.3	79.0	84.7	100.2	95.7
Total	183.4	182.7	121.2	143.0	163.2	152.1

Plan of Investigation—The plan of this experiment was to divide two pairs of mature work mules into two lots in such a manner that one mule in each pair was in each of the lots. It was the plan to work the mules in each pair together and on an evener during the entire experiment in order to insure the performance of an equal amount of labor by each mule in a given team. The mules were used during the experiment to perform regular farm labor and such hauling and grading as was necessary at the Experiment Station during that time.

The mules in both Lot I and Lot II received mixed clover and timothy hay as roughage. Lot I received a grain ration of shelled corn and Lot II was fed oats as a grain ration.

The amount of feed fed was governed by the condition and appetite of the animals.

Length of Experiment—The experiment was conducted as above outlined from March 17, 1909, to March 16, 1910, a total of 364 days or thirteen 28-day periods. At the close of this 364 day period, the two lots of mules were reversed so that during the second period the mules which had received corn and hay were fed oats and hay, and those which had received oats and hay were fed corn and hay.

The time required to make the change was from March 16, 1910, until April 6, 1910. From April 6, 1910 until April 5, 1911, a total of 364 days, Lot I received oats and hay and Lot II was fed corn and hay. The experiment was thus divided into two-364 day periods. The above reversal of the lots was made because it was thought that it would tend to eliminate the factor of individuality among the mules. From this plan it is evident that the mules in Lot I were comparable to those in Lot II and any difference in them was due to the rations fed.

The Mules Used—The mules used in this experiment were raised in Missouri and had been used on the University Farm for some time prior to the beginning of this experiment. Each pair was well matched in type, size, quality and age. The lighter weight mules were 'sugar mules,' while the heavier pair were draft mules. The lighter pair No. 1 and No. 2 were about ten years old and had an average weight of 1217 pounds. Beck, No. 2 in Lot I, was not so good a feeder as was her team-mate. The heavier pair of Mules, Julia, No. 3 and Mary, No. 4, were five years old and had an average weight of 1382 pounds. All the mules started on the experiment in good working condition. Julia, No. 3, was a better feeder than her mate.

Feeds Given—The feed was purchased at various times and from various sources. Both corn and oats were fed shelled. The grain was purchased through Kansas City firms and was inspected at that point. The corn fed was what is known on the market as No. 2 mixed and the oats were of good average quality. A part of the hay was purchased locally and a part purchased through Kansas City commission firms. It varied somewhat, but the quality was generally good. It was mixed clover and timothy and the amount of clover varied from ten to twenty-five per cent. The mules were fed from the same hay, consequently, the factor of variation in hay was constant in both lots.

Weights and Records. Accurate weights of all feed offered and refused were kept during both years of the experiment. The two 364 day periods during which the experiment was conducted were each divided into 13 periods of 28 days each. The initial and final weights here presented consist of an average of three weighings taken on consecutive days. The weights of each period consist of an average of single weights taken at the end of each week during the period. Weights of the mules were taken in the morning before the animals had had any water or grain.

Records were kept of the health of the animals and of any unusual circumstances which occurred during the experiment.

Maintenance of Health and Appetite. During the entire two years covered by this experiment there was no case of illness or derangement directly traceable to the rations which the mules received.

Spirit and Endurance of Mules. These mules were well matched in their ability to perform labor as was shown in the work done prior to the experiment. No difference was detected in their spirit nor in their ability to endure hard work and extreme heat. During the warmest summer weather when the mules were doing heavy work, they evidenced exhaustion to the extent that they occasionally did not eat their noon allowance of grain, but this was true in both lots.

The Labor Performed—A record of the number of hours and the kind of work that was performed by each mule in this experiment was kept during the entire two years, and classified as follows:

Light	Medium	Heavy
1. General work	1. Cultivating corn	1. Breaking ground
2. Hauling	2. Mowing	2. Discing ground
3. Gathering corn	3. Planting corn	3. Harrowing ground
4. Threshing	4. Rolling	4. Binding grain
		5. Drilling wheat
		6. Grading and scraping

Reference: Missouri Experiment Station Bulletin 114, Pages 308-10, 313-14, and 316-18, Tables 1-4, "Corn vs. Oats for Work Mules." Columbia, Missouri.

Suggestive—Use Form 3 suggested on Page 20 to determine whether it would be more economical to feed corn or oats. From which of the two can you grow more total digestible nutrients per acre? Which of the two fit into your farming program better? Which requires less labor per pound of total digestible nutrients? Which can you grow more successfully on your farm?

WHAT KIND OF ROUGHAGE SHOULD BE FED TO WORK STOCK?

The question as to the kind of roughage that should be fed to workstock is one of vital importance on many Mississippi farms. On many farms it may be more economical to feed large quantities of low grade roughage than to feed small quantities of a high grade roughage. The experiments reported here may help in solving this problem.

I

Table 11—Johnson Grass Hay vs. Soybean Hay For Work Mules (900 Day Test) at State College, Miss.

		Ration Per 1000 Lbs. Live Wt.									
		Lot I					Lot II				
		13.7 pounds Ear Corn					11.0 pounds Soybean Hay				
		12.0 pounds J. G. Hay									
		1925-26 Test					1926-27 Test				
No. of Mules	First Period (150 Days) Mar. 2-July 29, 1925	Second Period (150 Days) Sept. 14, 1925-Feb. 10, 1926					First Period (150 Days) Mar. 22-Aug. 18, 1926				
		Lot 1	Lot 2	Lot 1	Lot 2	Lot 1	Lot 2	Lot 1	Lot 2	Lot 1	Lot 2
Av. Initial Wt. (Lbs.)	5	5	5	5	5	5	5	5	5	5	5
Av. Final Wt. (Lbs.)	1226	1278	1278	1247	1243	1258	1243	1253	1274	1210	1206
Av. Gain or Loss in Wt. (Lbs.)	1230	1262	1278	1278	1258	1258	1237	1249	1235	1199	1199
Av. No. Days Worked per Mule	+4	+34	-11	+31	23	-6	-4	-39	-11	-7	-22
*Estimated consumption of feed per year on basis of 1000 lbs. live weight		95.8	91.8	60.0	54.9	59.9	92.3	60.6	75.1	107.1	98.3
		Lot 1—60.3 Bu. ear corn and 2.2 Tons Johnson Grass hay.					Lot 2—60.3 Bu. ear corn and 2.05 Tons soybean hay.				

On the basis of this experiment, one ton of soybean hay would be worth \$13.09 with Johnson grass hay costing \$12.00 per ton. * Mules were fed on the basis of their live weight. On idle days the moon feed of concentrates was omitted.

Plan of The Investigation—Five pairs of mules were used in experiments, in 1925-26 and 1927-28 and 6 pairs in 1926 and 1927. They were divided into two lots in such a manner as to place one mule in Lot I and his team mate in Lot II.

Six periods of 150 days each were used in this test. The first period started on March 2 and was concluded on July 29, 1925. The second period was from September 14, 1925 to February 10, 1926. The third period extended from March 22, to August 18, 1926. The fourth period started on September 27, 1926, and was concluded on February 3, 1927. The fifth period extended from March 5 to August 4, 1927. The sixth period was from September 12, 1927, to February 8, 1928.

At the beginning of the experiment, Lot I was fed ear corn and Johnson grass hay and Lot II was fed ear corn and soybean hay. At the close of the five months periods, the lots were reversed so that the mules that received the Johnson grass hay for the first period received the soybean hay for the second period. The exchange of lots occurred at the end of each period; consequently, during the three years of the test the mules in Lot I received the Johnson grass hay in the first, third,

and fifth periods and they were given the soybean hay in the second, fourth and sixth periods. The mules in Lot II received the comparable ration at the same periods. The reversal of the two lots was made to eliminate as far as possible the factor of individuality among the mules in the lots being compared. At the beginning of each period, about two weeks time was required to make the exchange of rations.

Feed Used—Mosby corn that was raised on the Station farm was used practically throughout the three years of the test. For two short periods of time, it was necessary to supplement the Mosby corn with a number 2 yellow corn that was purchased on the market, but the change of corn was made at uniform times for both lots.

Otootan soybean hay was used during the first year. This was very stemmy and at the time of cutting the crop a large number of the beans were mature. In the curing process, the leaves adhered to the stems and hay was green in color. Laredo soybean hay was the variety used in 1926-27. The soybean hay of this year was much finer in quality than of the previous year. The stems were much smaller and the leaves adhered in the curing process, but the hay was slightly damaged by rain before it was baled. The Laredo soybean hay used for the 1927-28 comparison was about the same texture as for 1926-27 and the hay was put up without any damage by the weather.

Feeding and Management—The mules were fed in individual box stalls. The grain was fed in equal amounts morning, noon, and night. The mules had free access to salt at all times. When working, the mules were given water when they were taken from the stalls and when they returned from work. On Sundays and idle days, the noon feed was omitted. When not at work, the mules were fed their regular ration morning and evening and turned on a pasture. During the warm season, they were turned out at night after they had finished eating.

Records and accurate weights of all feeds offered and refused were kept during the experiment. The initial and final weights of the mules consisted of an average of three weights made on consecutive days. Individual weights were taken of the mules every Monday after they were fed and watered.

In figuring the ration for Lot II, the same amount of corn was utilized as for Lot I and enough soybean hay was used in the ration to make the total digestible nutrients for the two lots as nearly equal as possible.

Maintenance of Health and Ability to Endure Work and Hot Weather—During the entire period of the experiment, there was no case of illness that could be traced to the rations that the mules received. Both rations were palatable and satisfactory. However, it was apparent that the soybean hay was relished more by the mules than was the Johnson grass hay. There was no noticeable difference between the mules of the two lots as to the way they stood their work and the heat, nor was there any difference in the spirit of the two lots.

Reference: Mississippi Experiment Station Bulletin 270, Pages 26-30, Table 3. August 1929, "Mule Feeding Experiments," State College, Mississippi.

Suggestive—Which of the two kinds of hay grows more abundantly on your farm?

Which fits into your farming program better?

Which requires the less labor?

Use Form 3 suggested on page 20 to determine which is more economical for you.

II

Table 12—Alfalfa Hay vs. Prairie Hay For Workstock at Lincoln, Nebraska
(90 Day Test)

Animal No.	1	2	3	4	5	6
Av. Initial Weight (Lbs.)	1720	1690	1350	1340	1240	1200
Av. Final Weight (Lbs.)	1760	1670	1330	1300	1260	1210
Av. Gain or Loss (Lbs.)	+40	-20	-20	-40	+20	+10
*Grain per Day per Animal (Lbs.)	15	15	12	12	12	12
Hay per Day—per Animal (Lbs.)						
Alfalfa	20		10		10	
Prairie		20		10		10
Av. Amount of Work done Daily						
per Work Day—(Hours)	8	8	7	7	7	7

*The grain was a mixture of coarse ground CORN and OATS of EQUAL PARTS. Animals No. 1 and 2 were Horses. The remaining 4 were mules.

Animals Used—For this particular test two teams of mules and one team of draft geldings were used. The four mules each received the same amount of grain. Supplementing this, one mule in each team received alfalfa hay, whereas the other received a like amount of prairie hay. Likewise, each of the horses received the same amount of grain with one receiving alfalfa and the other prairie hay. These three teams were chosen because they were to be worked regularly as heavy hauling and because the same animals were always worked together, thus insuring a like amount of work for both animals in each team.

Feeds Used—All hay and grain used in the test was weighed for each animal. The grain was a mixture of coarse ground corn and oats of equal parts. The hay was shipped from Lincoln County, Nebraska. The alfalfa was of a good grade with the exception that it contained some Russian thistles. The prairie hay also of good grade and of average composition. The feeding was done regularly at 6 A. M., 12 M., and 6 P. M. Only two-thirds as much grain was fed on Sundays as on week days. Initial and final weights represent the average of weighings taken on three consecutive days in each case.

Work Done—All six animals were in the harness every day, when the weather was fit. Most of the time was spent hauling coal and feed. The horses averaged 8 hours' work for every working day during the test, while the mules averaged 7 hours. This lesser amount for the mules was due to a lack of work for them at times. By comparing figures of the table attached it will be noticed that the mules consumed much less feed than the horses.

Method of Feeding—As all of the animals were being fed prairie hay prior to the experiment it was deemed best to start the three on alfalfa gradually. This was accomplished by feeding them alfalfa stems from the cattle racks for a month. Twenty pounds of hay per day was used in starting. The mules would not consume this much, however, and it was soon found that they were satisfied with half that amount.

Observations—A slight tendency to scour by the three fed alfalfa was noticeable at first, but by the end of the first week this trouble had ceased and aside from the color of the droppings there were no external indications of the rations being fed.

Reference: Nebraska Extension Bulletin 28, Pages 3, 4, and 5, August 1914, "Feeding Alfalfa to Horses." Lincoln, Nebraska.

It is assumed that prairie hay is somewhat similar to our grass hays. The following are some comparisons:*

Kind of Hay	Digestible Nutrients in 100 Pounds				
	Crude Protein	Carbohydrates	Fat	Total Nutritive	Ratio
Prairie hay, western	4.0	41.4	1.1	47.9	11.0
Sudan grass hay	3.7	45.7	0.9	51.4	12.9
Johnson grass hay	2.9	45.0	1.0	50.1	16.3
Crab grass hay	3.5	40.0	1.0	45.7	12.1
Swamp grasses	3.5	40.1	0.8	45.4	12.0

*Feeds and Feeding—Henry & Morrison, Appendix, Table III.

Suggestive—Under your conditions, could you better afford to feed prairie hay or alfalfa hay? Use Form 3 suggested on page 20 to determine the relative economy.

III

Table 13—Alfalfa Hay vs. Prairie Hay Fed to Army Horses in Kansas

Lot No.	12	5
No. of Horses	17	69
Av. Age of Horses	12	11
No. Days Fed	140	110
Av. Initial Wt. (Lbs.)	1163	1197
Av. Gain or Loss in Wt.	+26	-13
Grain Daily per 1000 lbs. Live Wt. (Lbs.)		
OATS	1.70	3.36
CORN	6.80	6.72
Hay Daily per 1000 lbs. Live Wt.		
ALFALFA HAY	8.50	
PRAIRIE HAY		11.75

Note the difference in pounds of oats fed daily to the two lots.

The conditions under which this test was run are the same as given under Table 9.

The horses in lot 12, received the smaller amounts of both grain and hay, showed better thrift and condition than those in lot 5 and did their work just as well in every respect. The ration used in lot 12 resulted in a reduction of 15.67 percent in the grain portion of the daily ration, and 27.7 per cent in the hay.

Reference: Kansas Experiment Station Circular 62, Pages 8 and 9, Table 5, November 1917, "Feeding Work Horses," Manhattan, Kansas.

Suggestive—How did the pounds of oats fed daily to the two lots compare? How did the pounds of hay compare? How did the gain or loss in weight compare? Compare the economy of the two according to Form 3 suggested on page 20.

WHAT IS THE RELATIVE VALUE OF COTTONSEED MEAL IN THE WORKSTOCK RATION?

With the abundance of cottonseed meal produced in Mississippi, it has been thought that cottonseed meal may be economically fed to workstock, especially during years of short corn or oat crops.

I

In Table 14 are reported two tests, one run in 1924 and another in 1932-33 at State College, Mississippi.

The rations for the four lots during the 1924 test were as follows:

Lot 1—Ear Corn, Cottonseed meal, Oats and Johnson grass hay .

Lot 2—Ear Corn and Johnson grass hay.

Lot 3—Ear corn, Cottonseed Meal and Johnson Grass Hay.

Lot 4—Ear corn and Johnson grass hay.

The rations planned for the two lots in the 1932-33 test are as follows:

Lot 1—3 pounds cottonseed meal, ground ear corn and 12 pounds Johnson grass hay per 1000 pound mule.

Lot 2—4 pounds cottonseed meal, ground ear corn and 12 pounds Johnson grass hay per 1000 pound mule.

Table 14—Feeding Cottonseed Meal to Work Mules at State College, Mississippi

	The 1924 Test						1922-23 Test	
	First Period (150 Days)			Second Period (150 Days)			(305 Days)	
	Lot 1	Lot 2	Lot 3	Lot 4	Lot 1	Lot 2	Lot 1	Lot 2
No. of Mules	5	5	5	5	5	5	6	6
Av. Initial Wt. (Lbs.)	1145	1065	1220	1220	1192	1083	1289	1265
Av. Final Wt. (Lbs.)	1221	1040	1267	1289	1085	1255	1227	1222
Av. Gain or Loss in Wt. (Lbs.)	76	-25	45	69	7	73	-62	-43
Av. No. Days Wk. Per Mule	89.2	97.9	100.4	66.9	69.3	69.5	85.8	.....
Ration: (Lbs.) Daily Per 1000 Lbs. Live Wt.	11.4	13.7	10.26	16.0	11.4	10.26	11.4	7.54*
Ear Corn	10.26	16.0	15.0	15.0	10	15.0	12.0	12.07
J. G. Hay	15.0	12.0	3.0	3.0	12	10.0	12.0	.....
Oats	3.0	.....	.....	.....	.....	3.0	.....	.....
Cottonseed meal	1.0	.....	1.1	1.1	.....	.....	2.32	2.96

*Ground Ear Corn.

PLAN OF 1924 INVESTIGATION

The plan of the experiment was to divide the 10 teams of mules into four lots. Five teams were divided in such a manner as to place one mule of each team in Lots I and II and the other five teams were divided between Lots III and IV.

The mules were used during the experiment to perform the regular farm work on the Experiment Station farm. The type of farming required the mules to be in condition and available for work throughout the year. Team mates were worked together practically all of the time.

The experiment was conducted as above outlined from March 1, 1924, to July 28, 1924, a total of 150 days. At the close of this 150-day feeding period, the mules in Lots I and II were reversed, so that during the second period the mules in Lot II received the rations formerly fed to the mules in Lot I.

The rations for the two lots were changed gradually. The time required to make the change was from July 28, 1924 to August 17, 1924. On this latter date, all of the mules in these two lots were consuming their rations well. The second period was started August 18, 1924, and concluded January 15, 1925.

During August the farm work was light, and as half of the mules could do the work at this season the mules in Lots III and IV were turned on pasture. The 10 mules on pasture from July 29 to September 1 made an average gain in weight of 39.7 pounds.

The first of September the mules in Lots III and IV were brought in from the pasture. The mules were reversed in the lots, so that each mule would receive the ration fed to his mate during the first period of the experiment. Fourteen days were required to change the rations. The second period of 150 days started September 16, 1924, and was concluded February 13, 1925. The experiment was thus divided into two periods of 150 days.

The foregoing reversal of the lots was made to eliminate, so far as possible, the factor of individuality among the mules in the lots being compared.

Mules Used—The 20 mules used in this test were raised on the Experiment Station farm. Each pair was matched as evenly as possible in gait, quality, type and size. The lighter weight mules would class as "cotton mules" and the heavier pairs as "draft mules."

Feeds Used—The Mosby corn used in the test was raised on the Station farm. Sixty-four pounds of ear corn were required to shell out 56 pounds or one bushel of shelled corn. The ears averaged about two and one-half to the pound. The supply of ear corn was insufficient for the test; so a Number 2 yellow corn was purchased on the Memphis market, and it was fed to Lots I and II from June 18 to October 9, and to Lots III and IV from September 1 to 25. In making the substitution of shelled corn for the ear corn in the rations, one pound of shelled corn replaced 1.14 pounds of ear corn. The rations and tables were figured and are reported in terms of ear corn.

The number 2 oats used in the test were purchased on the market. The cottonseed meal was bright in color and of good quality.

The Johnson grass hay was raised on the farm. The hay varied somewhat in quality, grading from a Number 1 to a Number 2. The mules were fed from the same feeds; consequently, the factor of variation in the feeds was constant in the lots being compared.

Feeding and Management—The mules were all fed in individual box stalls. The grain was fed three times a day, hay at night and water after the morning feed and before the night feed. When working, the mules were always given water when they were taken from the barn and when they returned from work. The corn was fed in three equal feeds. The oats and cottonseed meal were given in equal feeds night and morning. Salt was available at all times.

On Sunday and on idle days the noon feed was omitted. When not at work, the mules in Lots I and II were turned on pasture, and mules in Lots III and IV were turned in dry lot. During the warm season the mules were turned out at night after they had finished eating.

Maintenance of Health and Ability to Endure Work and Hot Weather—During the entire period of the experiment, there was no case of illness or derangement directly traceable to the rations the mules received. Occasionally some of the mules were "off feed" for a meal or two, but in all cases a temporary reduction of the amount of feed restored the appetite.

There was no noticeable difference between the mules of the four lots as to the way they stood their work and the heat. All four rations proved satisfactory in these respects.

PLAN OF THE 1932-33 INVESTIGATION

Date of test April 1, 1932 to March 28, 1933.

Purpose—It was the purpose of this test to determine how much cottonseed meal work mules would safely consume along with a grain-hay ration and how much grain varying amounts of cottonseed meal would replace. Two lots of 6 mules each were used in this test, each mule being fed in an individual stall.

Rations—It was planned to feed lot I a ration of 3 pounds cottonseed meal, ground ear corn and 12 pounds Johnson grass hay per 1000 pound mule, while mules in lot II were to receive 4 pounds cottonseed meal, ground ear corn and 12 pounds Johnson grass hay per 1000 pound mule. Ground ear corn was fed in amounts necessary to maintain the mules in working condition. The corn and meal were divided into two equal parts and fed morning and night. All hay was fed at night. Flake salt was available in each stall. The mules did not consume meal in the amounts as planned even though the corn allowance was limited in an effort to force the mules to consume large amounts of meal. The amount of corn in Lot II was reduced more than in Lot I, which accounts for their higher consumption of meal.

The test was discontinued from July 11 to September 12 while most of the mules

were idle and on pasture. Two mules were sold on February 6, 1933.

Cottonseed meal in amounts up to approximately 3 lbs. per 1000 pound live weight was fed to mules at hard work for a period of 305 days.

With 13.7 lbs of ground ear corn per 1000 pound mule taken as a standard grain ration for mules at hard work, 2.96 pounds of cottonseed meal replaces 6.16 pounds of ear corn; or, in amounts up to 3 pounds of cottonseed meal per 1000 pound mule, 1 pound of cottonseed meal replaces 2.08 pounds of ground ear corn.

Reference: Mississippi Experiment Station Bulletin 244, Pages 5, 6, 7, 9, and 14, Table 1, September 1927, "Mule Feeding Experiment" and Mississippi Experiment Station Information Sheet No. 12, June 1933, "Feeding Cottonseed Meal to Work Mules," State College, Mississippi.

Suggestive—According to the information given in Table 14 does it ever pay to feed cottonseed meal to workstock? Under what conditions? How does cottonseed meal stand the test of economy under present conditions when Form 3 suggested on page 20 is applied?

II

Table 15—Feeding Cottonseed Meal to Work Mules at Raleigh, N. C.

	Test 1 (182 days)						Test 2 (181 days)					
	(Six Months—Oct. 1908-March 1909)						(Six Months—Sept. 1909-Feb. 1910)					
	Mule No. 1—Shelled Corn alone						Mules No. 1, 3, & 5—Shelled corn alone					
	Mules No. 2, 3, 4, 5 and 6— Shelled corn and cottonseed meal	1	2	3	4	5	Mules No. 2, 4, & 6—Shelled corn and cottonseed meal, 1 part.	1	2	3	4	5
Mule No. consumed daily (lbs.) per animal:	11.66	8.22	9.48	8.86	10.63	10.28	8.85	6.46	8.37	6.53	8.44	6.48
Shelled Corn	.....	1.62	0.61	1.32	0.64	1.07	.....	0.92	.....	0.92	.....	0.91
Cottonseed meal	.....	90.1	85.6	76.1	83.2	83.5	82.6	78.6	83.4	83.4	63.8	34.4
Av. No. Days Worked	81.6	105.0	111.5	106.5	98.0	88.2	117.0	116.2	116.0	121.9	110.5	103.3
Initial Wt. (lbs.)	1150	1073	1101	1089	1016	954	1153	1112	1163	1231	1047	1054
Final Wt. (lbs.)	1172	1073	1101	1089	1016	954	1153	1112	1163	1231	1047	1054
Gain or Loss in Wt.	22	23	-14	24	35	72	-17	-20	3	12	-58	1

	Test 3 (153 days)						Test 4 (184 days)					
	(Five Months—April-Aug. 1909)						Six Months—July-Dec. 1910)					
	Mules No. 1, 3, & 5—Ear corn alone						Mules No. 1, 3, & 5—Corn and cob meal alone					
	Mules No. 2, 4, & 6—Ear corn, 7 parts; Corn & cob meal, 3 parts; and cottonseed meal, 1 part.	1	2	3	4	5	Mules No. 2—Corn and cob meal 8 parts and Wheat bran 2 parts; Mule No. 4—C. & C. Meal 8 parts; W. B. 2 parts; C. S. M. 1 part. Mule No. 6—C. & C. meal 6 parts; W. B. 2 parts; C. S. meal, 1 part.	1	2	3	4	5
Mule No. consumed daily (lbs.)	10.20	5.98	10.59	6.00	9.90	5.98	10.59	10.59	9.92	12.35	8.66	10.94
Ear Corn	.....	2.59	.....	2.77	.....	2.87	.....	.....	.....	.....	1.24	.....
Corn-cob Meal	.....	0.86	.....	0.92	.....	0.79	.....	.....	.....	.....	2.47	.....
Cottonseed Meal	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Wheat Bran	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Av. No. Days Worked	78.3	55.5	75.8	78.4	74.1	71.7	110.1	113.4	86.6	75.1	90.9	56.5
Initial Wt. (lbs.)	1052	1024	1056	1155	1035	994	1082	1055	1061	1150	1089	1006
Final Wt. (lbs.)	1115	1137	1152	1247	1081	1005	1088	1122	1205	1348	1185	1093
Gain or Loss in Wt.	63	113	96	92	46	11	6	67	144	98	96	87

A small amount of wheat bran (3 to 4 pounds per day) was used for a few days in the last part of test 3, in the Corn-cob meal and Cottonseed meal ration, to increase the palatability of the ration.

Roughages—The same kind of roughage was fed to each of the mules during corresponding periods in the experiment. Corn stover was the principal roughage fed. At various times the roughage consisted of oat hay, pea vine hay, and mixed hays, although the amount of these fed was a comparatively small part of the total roughage used. The amount of roughage supplied was determined by the appetite, the condition of the animals and the amount of work they were doing. The quantity of roughage given ranged from twelve to eighteen pounds per animal daily. The coarser portions of the corn stover were naturally refused, so that the actual amount eaten ranged from twelve to fifteen pounds per animal daily. A larger proportionate quantity of the other roughage feeds used was actually eaten.

Plan—During the first series of the experiment, which extended from October, 1903, to March 1909, the mules were weighed every two weeks. During the remaining series, weighings were made each week. The averages in the tables are taken from these figures.

The mules were worked in teams, whenever possible, one mule getting the cottonseed meal ration, and the other the corn products ration. As a limited amount of the farm work is performed with implements requiring only one animal, the amount of work varied in some cases. This condition, to a certain extent, influenced the quantity of feed eaten and the weights obtained, although in most cases the work performed was fairly well balanced with each team.

External Effect—Experimental evidence from this Station bears out the conclusion that there is a marked effect on the coat of the animal. It becomes smoother and glossier than usual after using cottonseed meal in the ration for a short time. When the cottonseed meal was fed in moderate quantities, not exceeding one and one-half to two pounds per day, the spirit and endurance of the animals was not below the normal. When larger quantities were fed, however, the mules not only lost in flesh and working capacity, but they refused to eat the cottonseed meal rations except in negligible quantities. Their condition grew so serious while being fed this ration that it was necessary to increase the amount of corn and decrease the cottonseed meal.

At the close of the experiment, the mules were all in normal condition. No trace could be found of any harmful effects resulting from feeding cottonseed meal.

Reference: N. C. Experiment Station Bulletin 215, pages 154, 155, 159, 162, 165, 168 and 169, Tables 4, 6, 8, and 10. (Amount of Feed Converted into Average per Day), June 1911, "Cottonseed Meal Feeding Experiments with Mules and Horses," Raleigh, N. C.

Suggestive—What was the highest amount of cottonseed meal fed per mule per day? How did cottonseed meal and feeds compare with other feeds alone in maintaining animal weight? How does the economy of the various rations compare according to Form 3 suggested on page 20?

Form 3—A Suggestive Method of Analyzing the Relative Economy of Various Rations Used in Experiments

[illegible]

*According to a standard set up by one or more Feeding Authorities. The same standard should be used throughout.

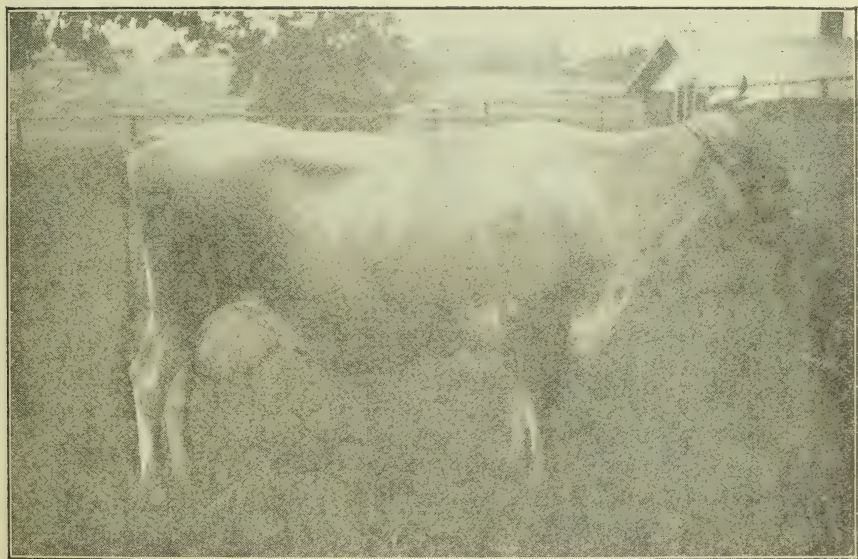
Form 4—A Suggestive Method of Evaluating Various Rations From Any Source to Determine The Best Feeding Program for Workstock For a Given Farm.

[illegible]

*Take the grand total figures from working out Form 2 (See page 5.)

PLANNING THE FEEDING OF FARM ANIMALS

SECTION II. PLANNING THE FEEDING OF DAIRY CATTLE



WHAT PERCENTAGE OF THE TOTAL DAIRY RATION MAY BE FED IN THE FORM OF ROUGHAGE?

I

In table 16 are reported two Experiments, the purpose of each being to determine the economy of various percentages of roughage fed in the ration. The first experiment, designated as Group I (10 cows) was run in 1919-26 at the U. S. Field Station at Huntley, Montana. The second experiment, designated as Group 2 (15 cows) was run at five U. S. Field Stations. In the first experiment, the cows were fed four kinds of roughage and pasture but the total digestible nutrients from roughage are reduced to pounds of alfalfa hay required to furnish them in order to be comparable to the second experiment. In the second experiment, the roughage ration consists of alfalfa hay alone.

Table 16—Full Grain Feeding of Dairy Cows as Compared to Feeding Limited Grain or Roughage Alone

(Each figure given as average per cow)	Group 1—10 Cows—Huntley, Mont.		Group 2—15 Cows	
	Roughage alone (10 cows)	Limited Grain 1 lb. grain to each 6 lbs. of milk (The same 10 cows)	Full Grain 1 lb. of grain to each 3 lbs of milk (The same 10 cows)	Full Grain 1 lb. Grain to each 3 lbs of milk (The same 15 cows)
Milk Production:				
Actual (Pounds)	13,295	16,407	15,793	-----
Calculated to maturity (Pounds)	13,656	16,649	17,851	11,375
Milk production % of that of full grain ration.....	76.5%	93.2%		63.2%
Butterfat:				
Actual (Pounds)	464	576	544	-----
Calculated to maturity (Pounds)	478	584	620	402
Feeds consumed (Pounds)				
Grain		2,710	5,266	6,003
Alfalfa hay		5,978	6,782	13,915
Corn silage	11,234	12,076	8,501	-----
Beet pulp	65	2	244	-----
Beets	1,345	527	2,258	-----
Days on Pasture	132	138	120	-----
Nutrients (Digestible) consumed excluding pasture:				
Crude protein	804.39	1,088.68	1,471.04	-----
Total digestible nutrients	4,977.64	6,848.69	9,015.33	-----
Digestible nutrients required for maintenance and production:*				
Crude protein	1,150	1,355	1,439	1,009
Total digestible nutrients (lbs.)	7,943	9,158	9,690	7,180
Feeds needed to supply nutrients required:				
Alfalfa hay (Lbs.)	15,394	13,528	9,631	13,915
Grain (Lbs.)	None	2,745	5,950	-----
Age (years-months)	6-4	7-0	4-2	-----
Weight (pounds)	1,240	1,331	1,238	1,279
Gain or loss in weight while while on ration (Lbs.)	30	108	180	-----
Dry period prior to test (days)	78	55	56	-----
Grain fed while dry (Lbs.)	132	111	186	-----
Period carrying calf (days)	175	155	188	-----

*According to Savage's Feeding Standard.

The First Experiment—Group I (10 cows)

Three Planes of Feeding—The experiment was conducted to compare the effect of three planes of feeding on milk production and on the economy of production: (1) Cows were fed roughage, consisting of alfalfa hay, corn silage, roots, and irrigated tame-grass pasture, and 1 pound of a standard grain mixture for each 3 pounds of milk produced daily (full grain ration); (2) the same cows were fed the same kind of roughages with 1 pound of grain mixture to each 6 pounds

of milk produced (limited grain ration); and (3) the same cows were fed the above roughages but received no grain (roughage ration). The records were for 365 days and were all made under the semi-official test regulations of the Holstein-Friesian Association of America. Ten cows have completed yearly records on the three rations.

The grain mixture used in the rations of both the full-grain and limited-grain groups was composed of 2 parts of mill feed*, 2 parts of ground oats, 2 parts of ground corn, and 1 part of linseed meal. Ten cows were used in the experiment, each cow completing a lactation period on each of the three planes at one time or another during the 7-year period 1919-1926. As a rule, the cows were placed on the full-grain ration first in order that an index of their producing ability might be obtained as soon as possible for inheritance studies. Their records were made under official-test conditions, the cows being milked three times a day.

The limited-grain group contained 1 individual under 4 years of age at the beginning of the trial, whereas the full-grain group contained 7. If considerable importance is attached to the factor of age, it is apparent that the later two groups received more nutrients than required, especially the full-grain group.

*No commercial feed is available that is known as "mill feed," so an average of equal parts of hominy feed, rice polish, wheat barn and wheat shorts was used in determining the nutrients contained. The analysis of this is 10.2% crude protein and 74.2% total digestible nutrients. Then, the entire grain mixture averages 12.1% crude protein and 76.9% total digestible nutrients.

The records in this experiment were not made concurrently. When a cow freshened she was started on one of the rations. If she had completed a year's record on limited grain, at the next freshening she was put on the full grain or on the roughage ration, and so on until she had completed records on the three different planes of feeding.

In conformity with the plan followed in the breeding projects of this bureau, all cows are given an official test on a full grain ration and milked three times a day throughout the year. The production record thus made is used in the inheritance studies as the animal's producing capacity. In the field station herds this record is obtained when possible when the animal is 2 years old in order to make more certain the obtaining of the record while the animal is physically sound. Then, too, if the record is delayed it may not be obtained at all on account of death or injury to the animal. This record has been used in the three planes of feeding experiment as the full-grain phase.

In view of the above practice the record on full grain was usually obtained before the records on roughage and limited grain. Since the record on full grain was made by cows milked three times a day, the cows making records on limited grain and roughage were also milked three times a day in order to make all the records comparable.

Table 16 gives the production records, the feed consumption, and other data for the 10 cows on each of the three phases of the experiment.

Good results were obtained from the feeding of roughage alone. Two cows produced more than 500 pounds of butterfat each without receiving any grain through the year.

In considering these results, three possible sources of error should be taken into account.

1. Largely because of the need of obtaining records under the most favorable conditions for the hereditary studies, most of the first records were made on the full-grain ration, only three of the animals being mature when these records were made. No attempt was made to correct the records for age because of the impossibility of making the same correction for feed consumption with any degree of accuracy. Consequently, the records made of animals on roughage and limited grain have the advantage of the greater age of the animals and of any development that may have taken place. Then, too, there is the possibility of a carry-

over effect from the full grain ration on the records made when the animals were on roughage.

To determine the extent of the error, the records of the cows lately started on this experiment are made in a different order. One heifer 2 years 7 months of age at the beginning of the experiment recently finished her first lactation year on a limited grain ration. She consumed 2,345 pounds of grain mixture, 5,896 pounds of alfalfa hay, 9,794 pounds of corn silage, and was on pasture 136 days. Her average weight for the year was 1,153 pounds. She produced 14,711 pounds of milk and 477.54 pounds of butterfat, the equivalent of 596 pounds of butterfat when correction was made for age. This record compares favorably with the average of 576 pounds of butterfat made by the 10 mature cows on the limited grain ration.

2. The second source of error is the possibility of a carry-over effect from the full grain ration on the records made when the animals were on roughage. To determine the extent of this error, a study was made of the records of three cows on the roughage ration that either preceded a full grain ration or followed a limited grain ration. The results are shown in Footnote Table 1.

Footnote Table 1—Production and Feed Consumption of Three Cows on a Roughage Ration Which Either Preceded a Full Grain Ration or Followed a Limited Grain Ration

Cow	Roughage	Full Grain	Limited Grain	Roughage
H-19				
Age:				
Years		2	3	5
Months		5	10	1
Weight (Lbs.)		1,200	1,309	1,292
Production:				
Milk (Lbs.)		16,887	17,754	16,755
Butterfat (Lbs.)		547	559	549
Pasture (Days)		138	151	140
Grain (Lbs.)		4,566	2,877	.....
Hay (Lbs.)		4,923	6,804	6,790
Silage (Lbs.)		10,158	10,330	10,439
Beets (Lbs.)		660	.....	1,085
218				
Age:				
Years	7	9	10	11
Months	7	1	3	5
Weight (Lbs.)	1,410	1,552	1,604	1,498
Production:				
Milk (Lbs.)	14,926	23,717	20,892	17,815
Butterfat (Lbs.)	453	713	627	526
Pasture (Days)	127	125	138	115
Grain (Lbs.) .....	.....	6,685	3,364	.....
Hay (Lbs.)	5,928	4,203	5,752	8,616
Silage (Lbs.)	14,271	13,885	14,825	13,764
Beets (Lbs.)	1,984	1,598	1,230	.....
H-204				
Age:				
Years	8	9	.....	.....
Months	3	11	.....	.....
Weight (Lbs.)	1,236	1,424	.....	.....
Production:				
Milk (Lbs.)	14,210	25,499	.....	.....
Butterfat (Lbs.)	470	823	.....	.....
Pasture (Days)	140	130	.....	.....
Grain (Lbs.) .....	.....	7,725	.....	.....
Hay (Lbs.)	9,014	10,068	.....	.....
Silage (Lbs.)	8,985	8,585	.....	.....
Beets (Lbs.) .....	.....	4,725	.....	.....

It will be noted that the record made by cow H-19 while on roughage was practically the same as her record made when 2 years of age on full grain. She had an average weight of 1,200 pounds during her first lactation period; this is somewhat greater than the average of 2-year olds.

The average weight of cow H-19 at 5 years of age, when on the roughage ration, was only 92 pounds greater than her average weight as a 2-year old. This represents an increase of only 8 per cent, which is considerably less than the usual increase in body weight between these two ages. Her average weight when 5 years of age was practically the same as it was when she was on the limited grain ration, which was started when she was 3 years 10 months old. Evidently she was just about able to maintain her weight on roughage and probably did not make the usual gain on limited grain.

The records of cow 218 are of exceptional interest because 2 were made on roughage, 1 prior to a record on full grain and 1 following a record on limited grain, and because all 4 records were made after the age of 7 years 7 months. The last record of this cow is the second largest record made on roughage at Huntley.

Although cow H-19 consumed approximately the same quantity of hay and silage on limited grain and roughage rations, cow 218 consumed 2,864 pounds more alfalfa hay on the roughage ration than on the limited grain ration. The difference partially made up for the loss of the 3,364 pounds of grain and the 1,230 pounds of beets she had had on the previous limited grain ration. Her last record made on roughage is the more remarkable because she was 11 years 5 months of age when the record started. During the period of these four records she was quite a regular breeder. She was not bred at any time until five months after freshening in order to give her time for a dry period after the year's record was completed. Cow H-19 made the largest butterfat record on roughage that has been made at Huntley, and that record was made following a record on limited grain.

Cow 204 had no limited grain ration; her first record was made on the roughage ration.

From the fact that the two highest records on roughage alone were made following records on a limited grain ration, it is probable that the carry-over effect of a prior full grain ration was not the cause for the good showing of the group while on the roughage ration.

3. The nutrients obtained from pasture are not included. On all rations, the cows had access to the same irrigated tame pasture with a carrying capacity of about 250 cow days per year. There is no accurate method of determining the quantity of grass that an individual cow will consume. The report given in Footnote table 2, shows that the cows on limited grain and on full grain grazed from 14 to 18 per cent less time than did those receiving only roughage.

Length of Time The Cows Grazed Daily—During the pasture season of 1927, observations were made of the number of hours that cows grazed when receiving pasture alone and when receiving other feeds in addition to pasture. The observations covered two days in June and two days in August. The cows were removed from the pasture each morning at 4 A. M. None of the cows were grazing at that time. They were returned to the pasture about 5 A. M., and a record was made of the time they grazed throughout the day. No record of the grazing time was made after 9 P. M. The results of these observations are shown in Footnote table 2

Footnote Table 2—Length of Grazing Time Per Day On Different Rations

Kind of Ration	Grazing period per day in		
	June	August	Average
	Hours	Hours	Hours
Pasture alone	8.97	9.35	9.16
Pasture and roughage ration	6.98	6.05	6.51
Pasture and a limited grain ration	5.05	6.15	5.60
Pasture and a full grain ration	5.06	5.60	5.33

In order to determine whether the cows on the roughage ration obtained more nutrients from pasture than did the cows on the other rations, a compilation was made of the milk and butterfat production and the feed consumption of the 10 cows on the different rations during the months in which they received no pasture. These data are given in Footnote table 3.

Footnote Table 3—Production and Feed Consumption of 10 Cows on Three Planes of Feeding When Not on Pasture

Average	Roughage	Limited Grain	Full Grain
Days on Ration	201	201	201
Production:			
Milk (Lbs.)	7,606	8,766	8,686
Butterfat (Lbs.)	266.9	312.1	308.8
Grain Mixture (Lbs.)		1,436	2,943
Alfalfa Hay (Lbs.)	4,516	4,214	4,290
Corn Silage (Lbs.)	8,867	8,728	6,826
Dried beet pulp (Lbs.)	51	1.3	148
Beets (Lbs.)	1,257	512	2,041
Average Weight (Lbs.)	1,240	1,333	1,246
Gain or Loss in Weight (Lbs.)	-23	87	106
Total Digestible Nutrients:			
Consumed	4,060	4,866	5,982
Required	4,255	4,748	4,631
Excess or Deficiency:			
Lbs.	-195	117	1,351
Per cent	-4.6	.....	29.2

Only 4 of the 10 cows on roughage alone gained in weight. It is rather remarkable that the quantity of milk and butterfat produced, the loss or gain in body weight, and the excess or deficiency in total digestible nutrients over the requirements do not bear a closer relationship. For example, cow H-19, the largest butterfat producer on the roughage ration, gained 42 pounds in weight and failed by 172 per cent to consume sufficient nutrients to meet her requirements; whereas cow H-1, the second highest producer, lost 217 pounds and failed by only 2.3 per cent to consume sufficient nutrients.

The cows on the limited grain ration gained an average weight of 90 pounds and consumed an average excess of only 2.4 per cent of nutrients over requirements. Only 1 cow, H-13, lost in weight, and this cow consumed an excess of nutrients over her requirements. Only 1 cow of the 10 failed to consume sufficient nutrients. The cows on this ration appear to have consumed sufficient nutrients to gain a little weight and to produce well up toward their capacity.

The cows on the full grain ration did not make much larger gains in body weight than did the cows on the limited grain ration. It appears that they wasted feed, the excess of nutrients consumed over their requirements for body maintenance and milk production amounting to 29 per cent.

The total digestible nutrients consumed over maintenance by the three groups in the 201 days per 1,000 pounds of milk, are as follows: Full grain ration, 476 pounds; limited grain ration, 335 pounds; and roughage ration, 292 pounds.

The number of days in the months in which they received no pasturage averaged 201, which is 55 per cent of the entire year. During these non-pasture months the cows when on full grain produced 56 per cent of their total yield for the entire year; on the limited grain they produced 54 per cent; and on the roughage ration they produced 57 per cent. This indicates that on the average the cows when on the three different planes of feeding produced at about the same rate on pasture as on hay and silage.

The important point brought out by this investigation is that where roughages of the right quality are available, cows of more than average producing ability have sufficient capacity to consume enough nutrients from roughage alone to meet their requirements; and where cows are allowed all the roughage they will consume and grain at the rate of 1 pound to each 3 pounds of milk produced, nutrients

greatly in excess of their requirements will be consumed and wasted.

The criticism may be made that the data given are obtained from too small a number of cows to make them significant. Footnote table 4 gives the average production of all cows at Huntley that have completed one or more records on these three planes of feeding. The last column shows the butterfat production calculated to maturity.

Footnote Table 4—Average Production of Cows That Have Completed Records on One or More Planes of Feeding

Cows	Ration	Milk Production	Butterfat Production	Years	Age Months	Butterfat Production calculated to
						Maturity
42.....	Full grain	14,868.1	591.08	3	8	613.4
13.....	Limited grain	16,200.5	566.86	6	1	588.9
15.....	Roughage	13,032.8	452.88	6	5	465.3

The averages for all cows that have completed records on one or more planes are somewhat lower than those of the 10 cows that have completed records on all three planes of feeding (Table 16). On the full grain ration the difference between the average butterfat production of the 42 cows and that of the 10 cows is 26 pounds; on the limited grain ration the difference between the butterfat production of the 13 cows and the 10 cows is 9.6 pounds; and on the roughage ration the difference between the average butterfat production of the 15 cows and the 10 cows is 11 pounds. The averages for the larger number of cows are somewhat more favorable to the limited grain and roughage rations than are the averages for the 10 cows.

It will be noted that the cows on the roughage ration in Group 1 had a production that was relatively greater in proportion to their production on the full-grain ration, than was the case of the cows in Group 2. This may have been due to two reasons: (1) The diversity of roughage received by the cows on the roughage ration in Group 1 and (2) the fact that some of the cows in Group 2 were past 9 years of age when they were started on the alfalfa hay, or roughage, ration, and some of them were not accustomed to a ration consisting of roughage only.

The Second Experiment—Group 2 (15 Cows)

The other feeding experiment, conducted more recently, was one in which 15 Holstein-Friesian cows were fed for a period of approximately 365 days on a ration consisting entirely of roughage (in this case the roughage was alfalfa hay). This experiment was carried on with one or more cows at each of the following stations: Beltsville, Maryland, Huntley, Montana, Mandan, North Dakota, Ardmore, South Dakota, and Woodward, Oklahoma. All of these cows had previously made production records on a full-grain ration under comparable conditions of management.

Table 16 also shows the calculated amounts of digestible nutrients these cows would require for their maintenance and this production (as calculated by the authors from the Savage feeding standards), as well as the calculated amounts of alfalfa hay and grain the cows would have to consume to obtain sufficient nutrients to meet these requirements.

In calculating the amounts of grain needed to meet these requirements for maintenance and production, the authors used a grain mixture consisting of two parts corn, one part wheat, and one part oats. This grain mixture is not the one the two groups of cows actually received in the feeding experiments, but it consists of standard farm crops and was selected for use in the calculation to make the results of this study more applicable to farm conditions. Also, the roughage actually fed in the rations for Group 1 consisted of corn silage, beet pulp, and pasture during the pasture season, as well as alfalfa hay, and for Group 2 the roughage ration was alfalfa hay alone. In all cases the roughage requirements have been calculated in terms of alfalfa hay.

The roughage used for comparison in this study was alfalfa, for the reason that alfalfa was fed in the two feeding experiments and also because of the fact that in most regions alfalfa will produce more nutrients per acre than other roughages. Other legumes and grasses can be used for a roughage ration, however.* There are probably very few regions in the United States where a roughage ration would be restricted to alfalfa hay alone. In most regions pastures can be advantageously used during a part of the year. It may be found too, that cows will consume more roughage and thrive better when the roughage ration is composed of several kinds of hay. Experiments § completed recently by the Bureau of Dairy Industry indicate that a pasture grass mixture, when cut at an immature stage of maturity and properly cured, is consumed in large quantities and is very efficient for milk production.

In the two experiments from which these calculations were made the cows were of considerably higher producing capacity than the average. The authors believe, however, that there is no question but that lower producing cows will be proportionately profitable on a roughage ration. The Bureau of Dairy Industry has data on 202 cows, with some 491 yearly production records, that were handled under farm conditions and that received a ration consisting entirely of roughage. For the most part the ration was alfalfa hay, but the cows were on pasture during the pasture season and fed sugar-beet tops during the fall. The average production of these cows was 7,544 pounds of milk and 277 pounds of butterfat (no calculations for immature age.) But it is not known what the production of these same cows would be if they were on a limited or full-grain ration.

In order to obtain good production on a roughage ration a first class roughage must be fed. The cows in the two experiments were fed a good grade of western alfalfa hay. The production levels obtained in these experiments probably could not have been attained if an "average" or "poor" grade of hay had been fed. Cows can not produce efficiently on hay that has become too mature before cutting, or that has been rained on a number of times or bleached out in the sun, or that has lost its leaves.

It is the author's experience that some cows that have been accustomed to a heavy grain ration do not take kindly to a ration consisting entirely of roughage. Such cows could probably best be handled by feeding a limited grain ration, from the beginning of the lactation period.

In some regions the low mineral content of the soil results in a low mineral content in the roughage grown. In such regions cows fed on roughage alone would not secure sufficient minerals to meet their needs.

§ Graves, R. R., and Dawson, J. R. Feeding Value for milk productoin of pasture grass when grazed, when clipped and fed green, and when cut at different stages of maturity and fed as hay or silage. Technical Bulletin No. 381, U. S. Dept. Agr., 1933.

*Consult table 29 for a comparison of alfalfa and soybean hay.

Reference: U. S. D. Technical Bulletin 353, Pages 44 and 45, 1933, "Agricultural Investigations at The Huntley (Montana) Field Station, 1927-1930." U. S. D. A. Washington, D. C.

U. S. D. A. Technical Bulletin 116, Pages 15, 18, 19, 20, 21, and 22, Tables 6, 14, 75 and 16, Jun 1929, "Dairy Work at The Huntley Field Station, Huntley, Montana, 1918-1927," U. S. D. A. Washington, D. C.

Mimeograph copy of "A Study of Certain Phases of The Economics of Dairy-Cattle Feeding," by R. R. Graves, Chief, and J. B. Shepherd, Associate Dairy Husbandman, Division of Dairy Cattle Breeding, Feeding, and Management, Bureau of Dairy Industry, Pages 1, 2, 14 and 15.

Suggestive—Which of these feeding methods is more economical under your conditions?

Form 5 is suggested as a method of determining which is more economical.

Form 5—Financial And Acreage Analysis of Various Dairy Feeding Experiments

FINANCIAL ANALYSIS OF FEEDING METHODS

[illegible]

ACREAGE ANALYSIS OF FEEDING METHODS

[illegible]

*Considering that the total T. D. N. from grain may be in the form of corn and cobmeal, (Toll for grinding should be subtracted from pounds per bushel if fed in ground form.)

***In case no cotton is grown on the farm, the cost of grain feed from milk receipts may be entered in this column.

Table 17—The Effect of the Rate of Feeding Grain on Profit Derived From Dairy Cows at Baton Rouge, La.—1930-1931
(The Normal Production in 1929 is Given as a Check Against the Results of the Test)

Lot No.	I				II				III			
	2 Jerseys and 3 Holsteins		1 Jersey and 3 Holsteins		2 Jerseys and 4 Holsteins		None		Full		Full	
Rate of Feeding Grain	Full	Low	Full	Ltd.	Full	Ltd.	Full	Ltd.	Full	Ltd.	Full	Ltd.
Year	1929	1931	1930	1930	1929	1930	1929	1931	1929	1931	1929	1931
Per Cow:												
Lactation days	291	288	320	293	311	293	303	297	303	297	299	299
Total Milk, lbs.	6535.2	6706.3	6208.1	7257.1	7257.1	7257.3	8004.3	6535.4	8004.3	4545.5	7575.4	7575.4
Milk per day lbs.	22.42	23.49	19.40	23.33	23.33	23.42	26.42	22.42	26.42	15.3	25.33	25.33
Total Butterfat, lbs.	255.0	257.6	232.7	269.1	269.1	269.1	289.9	255.0	289.9	17.0	278.6	278.6
Grain, lbs.	1993	1286	1966	1609	2091	1609	2389	1488	2389	127	2611	2611
Hay, lbs.	595	1038	821	937	602	937	724	1066	724	854	854	854
Slilage, lbs.	4769	3994	4444	4580	4445	4580	5611	3540	5611	4057	4057	4057
Loss in weight, lbs.	—55	—47	—55	—12	—12	—12	—30	—30	—30	—30	—19	—19
4% Corrected milk yield	6405.1	6570.5	5973.7	7017.4	6946.8	7017.4	7724.2	6103.2	7724.2	4473.2	7509.2	7509.2
Lbs. milk per lb. grain	3.26	5.11	3.04	3.32	3.32	4.36	3.23	4.10	3.23	2.76	2.76	2.76

Method of Conducting Experiment—Three groups consisting each of 6 Holstein and 3 Jersey Cows were fed as follows:
In 1930:

Group I—Grain fed at full rate—one pound grain to each four pounds of Holstein milk, or one pound grain to each three pounds Jersey milk. For 30 days previous to calving, all cows fed 4 pounds grain per day in fall and winter.

Group II—Grain fed at limited rate—one pound grain to each six pounds of Holstein milk, or one pound grain to each 4.5 pounds Jersey milk. Each cow fed 2 pounds grain in fall and winter, 30 days previous to calving.

Group III—No grain fed—roughage only.

In 1931—Eight cows were substituted for eight that were discarded at the end of the 1930 test.

Group I—Fed grain at the rate of one pound per gallon of Holstein milk with a minimum of two pounds of grain per day. Two pounds per day were fed for 30 days previous to calving.

Group II—Fed the same ration as the year before

Group III—Full fed grain at about the same rate as Group I the year before

Complete data are shown in Table 17. The average for Group I and Group II especially the latter, for the first year are rather high because added cows are included with normal herd records for that year. Also the unequal distribution of breeds makes the average roughage consumption appear nearly equal for the groups.

For the above reason, Table 17 has been prepared to show the average for two experimental and one normal year on the same cows

Roughage—Consisted of Legume Hay, and Corn and soybean silage fed from October to March in indirect proportion to grain.

1930—The difference in roughage consumption is not clearly shown in the average results as Group II finally included three Jersey cows while the other groups had only two each. This lowered the average roughage consumption of Group II. Individual cows varied widely in their ability to consume roughage. Six of the thirteen cows that completed a normal record gave more production on large amounts of roughage than the previous year. Four of these were Jerseys. However, the roughage group dropped more and earlier in production on pasture than the other groups, probably due to an actual shortage. Grain and roughage fed furnished only 50 percent for Group I, 45 percent for Group II, and 28 percent for Group III of the estimated amount of nutrients required for production and maintenance. Pasture was apparently responsible for the remaining percentage in each case.

1931—As roughage feeding was discontinued nearly a month earlier than in 1930, cows again suffered a feed shortage in being restricted to short intervals of grazing. During the year two cows died, (one from clover bloat,) one contracted udder infection, and five cows calved prematurely. These irregularities cannot be attributed to the methods of feeding.

Grain—Consisted of a mixture of 400 pounds cornmeal or hominy, 200 lbs. each of wheat bran, oats and cottonseed meal, 15 pounds salt and 10 pounds of bone-meal. This mixture analyzes approximately 14 percent digestible protein.

Ration Adjusted—In winter, on the first day of each month the rations were adjusted to the Henry & Morrison Standard, but no effort was made to avoid any excess in proteins. In summer, the proposed rate of grain feeding was followed, but due to decline in production and dry periods, more grain than this was actually fed.

Pasture—All cows had access to the same alluvial land pastures which consisted mainly of White Dutch clover and Dallis grass with considerable Bermuda in late summer. Certain pastures contained Italian rye grass. Oats were pastured during a part of the first year. The dry weather early in 1930 and mid-summer of 1931 decidedly reduced the grass supply per cow, and optimum grazing was not always available. However, the average acre yield of grass from caged areas was 43,068 pounds and of air-dried hay 11,290 pounds for the three summer seasons. This was enough feed material, if evenly distributed, to support one and three-quarters Jersey cows giving two and one-half gallons milk per day for over seven months.

Cows Used—Cows were picked that freshened from the middle of August to the end of December and which had a normal record starting at approximately the same time the previous year. Cows of moderate production and of mature age were used in so far as possible. Cows of second or third calving, and three cows of ten years of age, were apportioned throughout the groups by a pairing system. Butterfat records of the previous year were used to give a uniform average production of each group. Liveweights were taken for three consecutive days at the beginning to divide the groups according to size, but as several cows in each group were heavy in calf or had just calved, this was not entirely satisfactory. Cows were allotted as to date of calving or probable calving. The final grouping and average condition for the first year were as follows:

Av. Age	Av. Weight	Production for previous 12 months	
		Milk	Butterfat
Group I 5 yrs.-5 Mos.....	1127	7281	278
Group II 6 yrs.....	1080	7331	278
Group III.....6 yrs.....	1179	6819	275

All cows were weighed for two consecutive days at the end of each month.

Milking—Cows were milked by machine twice daily and a complete milk record

maintained, starting the fifth day after calving. A one-day milk test was made near the middle of each month for determining butterfat yields.

Breeding—Breeding was delayed to permit calving at as nearly the same time each year as possible.

Results—Results of the first two years then indicate that full grain feeding apparently increased production 60 percent over roughage alone. On the other hand, cows on low grain after a full grain year produced equally as well. Cows on limited grain for two years failed to maintain quite as high production the second year in spite of better pasture conditions. There was considerable variation among the cows. All on full grain produced more than on roughage only, while four of seven produced more on low grain than previously. Two of these were Jerseys. The low grain groups dropped faster in production after June than those on full grain, probably due again to an actual feed shortage. Grain and roughage fed furnished only 41, 42, and 54 percent, respectively of the estimated amount of nutrients required for the second year, the difference being due apparently to pasture.

Reference: Louisiana Bulletin No. 241, Pages 2, 3, and 7, Table III, October 1933, "Grain as a Supplement to Pasture and Other Roughages for Milk Production." Louisiana State University, Baton Rouge, La.

Suggestive—In lot 1, how did the milk production on low grain compare with that on full grain? How did the butterfat compare? How did the grain and hay consumed compare? How do each of these items compare in each of the other lots? According to Form 5 suggested on page 29, which is the most economical ration?

III

Alfalfa Plus Grain vs. Alfalfa Alone at State College, New Mexico.

In the spring of 1910 and 1911 experiments were run to determine whether it pays to feed grain in addition to first-class alfalfa hay.

The first year there were two lots of five cows each in the experiment, and the second year six cows in each lot. The lots were fed alfalfa in separate corrals and the grain was fed in the milking stable at milking time.

Experiment 4—February 12 to April 18, 1910

This experiment extended over two periods of thirty days each, with a five-day interval to change the feed. The grain ration consisted of equal parts of corn and bran. During the first period Lot I received six pounds of grain per head, daily, and all the alfalfa they would clean up well; and Lot II alfalfa alone,—all they would clean up. For the second period the lots were interchanged and Lot I received the alfalfa alone.

Table 18—Alfalfa and Grain vs. Alfalfa Alone at State College, New Mexico

Lots Fed Alfalfa Plus Grain	Alfalfa Fed	Grain Fed	Cost of Feed	Milk Produced	Feed Cost	Butter-fat Produced	Feed Cost
					per Cwt. of Milk		Per Lb. of B. F.
	Lbs.	Lbs.	Dollars	Lbs.	Cents	Lbs.	Cents
Period 1, Lot I	4512	900	.....	2028	.....	102.8	.....
Period 2, Lot II	3126	900	.....	1900	.....	105.2	.....
Both periods	7638	1800	.....	3928	.....	208	.....
Av. per cow per day	26 $\frac{1}{4}$	6	.....	13.1	.....	.693	.....
Lots Fed Alfalfa Alone							
Period 1, Lot II	5333	.....	.....	1661	.....	100.5	.....
Period 2, Lot I	4310	.....	.....	1793	.....	88.3	.....
Both periods	9643	.....	.....	3454	.....	188.8	.....
Av. per cow per day	32	0	.....	11.5	.....	.629	.....
Increase due to grain	—2005	1800	.....	474	.....	19.2	.....

The lots that received the grain made a gain in weight of 171 pounds as compared to a gain of 93 pounds by the lots fed no grain.

Experiment 5—February 4 to April 11, 1911

Table 19—Alfalfa and Grain vs. Alfalfa Alone at State College, New Mexico

Lots Fed Alfalfa Plus Grain	Alfalfa Fed	Grain Fed	Cost of Feed	Milk Produced	Feed Cost per Cwt. of Milk	Butterfat Produced	Feed Cost per Lb. B. F.	Change in Weight
	Lbs.	Lbs.	Dollars	Lbs.	Cents	Lbs.	Cents	Lbs.
Period 1, Lot II.....	4376	1136	.....	2935	.....	133.0	.....	+250
Period 2, Lot I.....	3995	1316	.....	2546	.....	108.8	.....	+262
Both periods.....	8371	2452	.....	5481	.....	241.8	.....	+512
Av. per cow per day.....	25	7.33	.....	16.3	.....	.72	.....	+1.5
Lots Fed Alfalfa Alone								
Period 1, Lot I.....	5390	.....	.....	2600	.....	113.0	.....	+80
Period 2, Lot II.....	4861	.....	.....	2359	.....	103.6	.....	-127
Both periods.....	10251	.....	.....	4959	.....	216.6	.....	-47
Av. per cow per day.....	30.5	.....	.....	14.75	.....	.64	.....	-.14
Increase due to grain.....	1800	2452	.....	522	.....	25.2	.....	+559

Reference: New Mexico Agricultural Experiment Station Bulletin No. 98, pages 17, 18, 19 and 20, Tables 6 and 7, June 1915, "Economic Feeding for Milk Production in New Mexico." Las Cruces, New Mexico.

IV

Table 20—Comparison of the Consumption of Different Hays at Beltsville, Maryland (Average For 10 Cows)

Period No.	Kind of Hay Fed	Average Quantity of Hay Eaten Daily per Cow	Average Daily Yield of Milk per Cow	Average Decline in Milk Yield*
		Pounds	Pounds	Per Cent
1.....	No. 1 Alfalfa.....	14.4	28.8	....
2.....	No. 2 soybean.....	12.4	27.6	4.7
3.....	No. 3 alfalfa.....	12.8	26.3	3.5
4.....	No. 2 clover.....	8.9	24.4	8.3
5.....	No. 2 timothy.....	12.6	23.0	4.6
6.....	No. 2 alfalfa.....	13.0	22.3	5.0
7.....	No. 1 timothy.....	13.0	20.8	5.6
8.....	No. 1 alfalfa.....	14.8	20.7	2.6

*By comparison of last three days of 20-day period with last three days of preceding period.

Silage was fed at the rate of 3 pounds daily per 100 pounds of live weight. In the case of Holsteins, grain was fed at an average rate of 0.4 pounds of grain for each pound of milk produced above 16 pounds; and in the case of Jerseys, 0.6 pound of grain for each pound of milk produced above 10 pounds, adjustment being made the first of each month. The data given are for the last 10 days of each 20-day period, the first 10 days being required to adjust the quantity of hay to the appetite of the cow and to accustom the cow to the hay.

The table shows that a change from timothy to alfalfa rearded the decline in milk production. Part of this may have been due to the fact that the protein of the grain ration was adjusted for alfalfa hay, and that the cows received insufficient protein when fed the timothy.

Reference: United States Department of Agriculture, Miscellaneous Publication 130, pages 14 and 15, table 8, "Feeding and Management Investigations at The United States Dairy Experiment Station at Beltsville, Maryland, 1930 Report," January, 1932.

V

A New Method of Apportioning Grain to Dairy Cows Tested at Beltsville, Maryland

The method tested is to give cows 3 pounds corn silage per day per 100 pounds live weight and all the alfalfa hay that they will eat, then give grain to Jersey cows at the rate of 0.6 pound for each pound of milk produced above 10 pounds and to Holstein cows at the rate of 0.4 pound for each pound of milk above 16 pounds.

It is based upon two facts which are considered fundamental in the economical feeding of dairy cows: (1) A cow should be fed all or nearly all the good roughage

she will eat; (2) Cows should at all times, except for a few weeks after calving, receive enough feed to provide the nutrients required for the production of milk and the maintenance of body weight without any loss of weight but with no more than a small gain.

The ordinary method of apportioning grain is to give each cow 1 pound of grain to each 3 or 4 pounds of milk produced, depending upon the richness of the milk. This method is inaccurate for two reasons: (1) because cows will get enough nutrients from good roughage alone to provide for the maintenance of their bodies as well as for the production of a certain amount of milk, and (2) because 1 pound of grain does not contain sufficient nutrients for as much as 3 pounds of milk. The tendency, therefore, is to bring all members of the herd to a uniform rate of production.

Since it is not practicable on dairy farms to weigh the hay fed to each individual cow, the first step in this investigation was to determine how much hay cows of different breeds and sizes would consume when given all they would eat along with a definite quantity of silage. The small cows ate about 8 pounds of hay a day above the amount required for maintenance whereas the large cows ate about 10 pounds above maintenance requirements, when cows were fed 3 pounds of corn silage a day for each 100 pounds of live weight, and all the No. 2 and No. 3 alfalfa hay they would eat. It was estimated from the Savage feeding standard that the nutrients in 8 pounds of hay would be ample for the production of 10 pounds of milk in the case of Jerseys and 10 pounds of hay would provide nutrients for at least 16 pounds of milk in the case of Holsteins.

It is assumed, therefore that if cows are fed silage and all the medium to good hay they will eat, only those producing more than the amounts just stated will require grain. According to the Savage standard, 0.6 pound of a grain mixture in which half of the ingredients are of a bulky nature (as ground oats or wheat bran) will provide the nutrients required for 1 pound of average Jersey milk and 0.4 pound will suffice for 1 pound of average Holstein milk. The method, then, is to give grain to Jersey cows at the rate of 0.6 pound for each pound of milk produced above 10 pounds and to Holstein cows at the rate of 0.4 pound for each pound of milk above 16 pounds.

This method was given a practical trial at the experiment station of the Bureau of Dairy Industry at Beltsville for three winters. Altogether 40 Jersey cows were fed a total of 162 cow months and 31 Holstein cows for a total of 83 cow months. The quantity of grain was adjusted on the first of each month. The hay was mostly No. 2 alfalfa, and the corn silage was of average quality.

The results of this test are as follows:

Table 21.—Does The New Method of Apportioning Grain Give the Usual Decline in Milk Production and Gain in Body Weight?

Breed of Cows	No. Cows	Cow Months	Average Daily Ration				Decline in Milk from First to Last of Each Month	Gain in Body Weight Per Month
			Average Weight Per Cow	Grain (Lbs.)	Hay (Lbs.)	Silage (Lbs.)		
Jersey Cows	40	162	970	7.3	12.7	27.6	9.3%	5.2 lbs.
Holstein Cows	31	83	1210	8.5	17.0	35.4	8.5%	6.9 lbs.

The Jersey cows produced a daily average of 22.5 pounds of milk testing 5.25% butterfat for an average lactation period of 152 days. The Holsteins produced a daily average of 36.5 pounds of milk testing 3.4% butterfat for an average lactation period of 122 days.

The grain ration used was composed for the most part of 100 pounds of hominy feed, 100 pounds of ground oats, 100 pounds of wheat bran, 50 pounds of cottonseed meal, 50 pounds of linseed meal, and 4 pounds of salt. This mixture contained, on the basis of average analyses, about 19 per cent total protein.

If the adequacy of a ration may be judged by comparison with a standard, by the gains in live weight, and by the decline in milk production this method of feeding, on the whole, is satisfactory.

The next questions were: 1. Does it provide adequate nutrients for cows in different stages of lactation?

2. Does it provide adequate nutrients for cows giving different quantities of milk?

The purpose of the first study was to determine the effect of this method of feeding upon the gain or loss in milk production and in body weight at various stages of lactation and also to compare the nutrients received with those required. On account of the necessity for choosing only cows which could be used without interfering with other investigations, some of the cows were on this experiment for only a month or two. A summary is given in Table 22.

Table 22—Does the New Method of Apportioning Grain Provide Adequate Nutrients For Cows in Various Stages of Lactation?

Breed of Cows	No 30-Day Periods	No. Cow Months Repre- sented	No. Days After Calving that Feeding Began		Average Decline in Milk Production from Month to Month after 1st. Month	Average Gain in weight from Month to Month after 1st. Month
			Lowest	Highest	(Per cent)	(Pounds)
Jersey Cows	10	131	15 days or less	256-285	8.53	6.41
Holstein Cows	7	58	15 days or less	166-195	8.91	5.55

Except during the first month or so after calving the cows consumed all the digestible nutrients required; the declines in milk production were not unduly large at any stage of lactation; and, after the first month or two there was, in general, a small gain in weight.

The cows were next grouped, by breeds, according to the quantity of milk produced. The Jerseys fell into five groups, ranging from those giving less than 10 pounds to those giving more than 40 pounds of milk. The Holsteins fell into six groups, ranging from those giving less than 20 pounds to those giving more than 60 pounds of milk. In this grouping, the Jerseys had a weighted average decline in milk production from month to month of 9.7% and a weighted average gain in body weight from month to month of 4.8 pounds.

The Holsteins had an average decline in milk production from month to month of 6.8% and an average loss in body weight from month to month of 3.8 pounds. This loss of body weight in the Holstein cows instead of gain, was due largely to 23 cows in the 60 to 74 pound group that lost an average of 36 pounds per cow per month. In both the Jersey and Holstein groups, the highest gains in body weights were made by the cows in lower daily production groups.

All of the cows, except a few of the highest producers, ate enough nutrients to meet their requirements for both maintenance and milk production, and the few exceptions failed by only a small margin. The highest producers lost some weight, which may be explained, at least in part, by the short time that had elapsed since calving. The rest of the cows in most cases made satisfactory gains in weight. The declines in milk production are about such as would be expected, except for the lowest producing group of Holsteins. Three of the six cows in this group were drying off rapidly and were entirely dry within 10 days after being taken off the experiment. The fact that they were at the same time making good gains in weight would encourage the belief that the method of feeding was at least not wholly responsible for the abnormal decline of this group.

While the cows used in these experiments were Jerseys and Holsteins, the

method may be applied in like manner to other breeds of dairy cows, as follows: Give Guernsey cows grain at the rate of 0.55 pound of grain for each pound of milk produced above 12; give Ayshire and Brown Swiss cows 0.45 pound of grain for each pound of milk produced above 14 pounds.

This method is not presented with the idea that it will apply to all conditions, but it does apply in all cases where silage and a good quality of hay is provided for the herds. The following hays, if cut reasonably early and so cured as to retain most of the leaves and much of the natural green color, will be eaten in such quantities that the grain may be apportioned as suggested: Alfalfa, soybean, timothy, and mixed timothy and clover.

In the application of this method certain improvements appear desirable. For example, Jersey cows producing milk containing less than 5 per cent butterfat may be fed 0.5 pound of grain instead of 0.6 pound, and those producing milk containing more than 6 per cent may be fed 0.7 pound of grain for each pound of milk produced above 10 pounds.

Another point on which further assurance is needed is whether cows are properly nourished on a ration of roughage alone. The appearance and the gains in weight of the cows in these experiments when fed roughage alone indicate satisfactory nourishment, although certain investigations suggest the possibility of a phosphorus deficiency.

Reference: United States Department of Agriculture Miscellaneous Publication No. 130, Pages 1-6., Tables 1 and 2, January 1932, "Feeding and Management Investigations at the United States Dairy Experiment Station at Beltsville, Maryland, 1930 Report," Washington, D. C.

Suggestive—Would this method of apportioning grain be more economical than the usual method of feeding one pound of grain for each 3 pounds of milk for a cow giving 10 pounds of milk per day? For a cow giving 20 pounds per day, 30 pounds? 40 pounds?

Use the Form 5 suggested on page 29 to determine which of the feeding methods would be more economical.

VI

A Test of Various Methods of Apportioning Grain to Dairy Cows Near Fallon, Nevada Plan of Experiment

For the purpose of the experiment 21 grade Holstein cows were purchased in 1925 from farmers of the Newlands project and assembled at the U. S. Experiment Farm near Fallon, where the experiment was to be conducted. It was the intention to build the herd as soon as possible to a total of 25 cows.

A feeding and milking shed was constructed with the east side continuously open so that the cows received about the same exposure to the weather as they do on most farms in Nevada. They are fastened in the stanchions only during the milking period and at other times are free to pass in or out of the shelter as they wish.

The barn and corrals were divided into five equal divisions 25 feet wide and extending 200 feet to the east. The herd was divided into five groups for the purpose of the experiment, each cow to remain in the same group through the remainder of her productive life. The plan of the feeding experiment was as follows:

Group I—Cows to receive alfalfa hay continuously without any supplementary feed whatsoever.

Group II—Cows to receive alfalfa hay and 1 pound of grain for approximately 5 pounds of milk produced, but no other feed of any kind.

Group III—Cows to receive alfalfa hay continuously and grain each alternate

lactation period. They receive no other feed of any kind. During the first year (1926) they were fed grain every other month.

Group IV—Cows to be used to try the effect of various feeds available at different seasons of the year, such as silage in winter, pasture in summer, and beets and mangels when available. The cows in this group receive no grain.

Group V—Cows to be fed in the same manner as those of group IV except that they receive a supplementary grain ration.

In group I four of the cows were retained without change throughout the four years of the experiment, also four cows in group II and all five cows in group III. Groups IV and V were never built up to the full quota of five cows each, and these groups were so frequently interfered with by death or sickness that the results can hardly be used. The results from groups I, II and III, however, are of interest.

Table 23—A Four-Year Average (1926-29) Test of Various Methods of Apportioning Grain to Dairy Cows

Average per cow per lactation period (figures represent pounds)	Group I	Group II	Group III
	Alfalfa Hay	Alfalfa Hay and Grain	Alfalfa hay continuously with Grain Fed on Alternate Lactations
Milk Production	8,644	10,352	9,163
Butterfat Production	304	359	326
Hay Consumption	13,458	12,408	13,057
Grain Consumption	None	2,160	774
Weight per Cow	1,355	1,371	1,304
Total digestible nutrients consumed per pound of butterfat produced (conversion factor)	24	24	23.1

It was thought at the beginning of the experiment that the all-hay ration might induce depraved appetite which has been acquired by a number of the dairy herds in the Newland project, but no pronounced case was noticed in any of the groups during the four years of the experiment.

Rations—Selected alfalfa hay was used from the beginning of the experiment. It was invariably of good quality and contained little foreign material.

When the herd was first assembled the grain-fed cows were given rolled barley unmixed with other concentrates, but so much bloat resulted that it soon became necessary to feed millrun with the barley in the proportion of two-thirds barley and one-third millrun. Bloating occurred less often but was still dangerous. To lessen still further the danger from bloat, the grain mixture was changed in January, 1928, to one-third barley, corn and millrun. This proved to be a very satisfactory combination and very little bloat was experienced after its adoption. No bloat was reported for cows not receiving grain.

Apparent Effect of Grain Feeding On Production—The difference in production cannot safely be attributed entirely to the difference in rations, since there is no way of knowing if the cows of each group were of equal productivity. Rather remarkable results were obtained from the cows in group I not receiving grain, since their level of production during the past three years was maintained well above 300 pounds of butterfat per year. It was one of the objects of the experiment to find if cows on an all-hay ration can maintain a high level of productivity without reduction because of lack of some vital element of nutrition.

The production of group II dropped off abruptly in the fourth year (from an average of 10,648 pounds for the first three years to 9,574 pounds for the fourth year.) This is a result of accident in breeding and is not necessarily correlated with the fact that this group is grain fed.

The effect of grain in increasing the butterfat production is also indicated by the records of group III in which the cows received grain every other lactation period. This permits a comparison of the production of the same individual cows

both with and without grain in the ration. There is probably a slight error in the results because of the hold-over effect of grain into the no-grain period. The result of this would be to lessen the effect of the grain.

The average production of milk by this group for the first 250 days of the lactation period was 32.0 pounds when on the all-hay ration and 37.7 pounds when receiving grain. The increase of butterfat per cow from feeding grain amounted to .2 pound daily for 250 days.

Footnote Table 1 shows the cost of producing butterfat is influenced by varying the price of alfalfa hay and by the varying efficiency of individual cows. The efficiency is measured by the pounds of total digestible nutrients required to produce one pound of butterfat, known as the conversion factor.

The food cost of producing butterfat by cows receiving an all-alfalfa ration may vary between wide extremes. When hay is \$8.00 per ton, a cow having a conversion factor of 16 can produce butterfat at a cost of 12 cents per pound for food, but it would cost 27 cents a pound when produced by a cow of low efficiency having a conversion factor of 35, as was the case with the poorest cow in group II.

When cows are receiving an all-alfalfa ration, the feed cost of butterfat is directly proportional to the price of hay.

Footnote Table 1—Feed Cost of Butterfat in Cents Per Pound When Cows Are Fed a Sole Ration of Alfalfa Hay. Cow Efficiency and Hay Price Variable

Conversion factor of cow	\$8	\$10	Price of Alfalfa Hay \$12	\$14	per Ton \$16	\$18	\$20	\$22	\$24
14	11	14	16	19	22	24	27	30	34
16	12	16	19	22	25	28	31	34	37
18	14	17	21	24	28	31	35	38	42
20	16	19	24	27	31	35	39	43	47
22	17	21	26	30	34	38	43	47	51
24	19	23	28	33	37	42	47	51	56
26	20	25	31	35	40	45	50	55	61
28	22	27	33	38	43	49	54	60	65
30	23	29	36	41	47	52	58	64	70
32	25	31	38	43	50	56	62	68	74
34	26	33	40	46	53	59	66	73	79
36	28	35	43	49	56	63	70	77	84

Based on 51.6% total digestible nutrients in hay

Factor $\times$ Cost Hay in cents per pound = Feed Cost of Butterfat.

.516

Economics of Feeding Grain in Ration—When grain is added to the ration cows produce more butterfat than when no grain is fed. It is possible to determine with a fair degree of accuracy the cost of producing this increased amount of butterfat which results from the grain fed. It is necessary to know the price of grain and the efficiency of the cow as expressed by the conversion factor. The cost of additional increments of butterfat from grain feeding can then be found in Footnote table 2. For instance, it will be found in the table that increased yields of butterfat will cost 38 cents per pound when grain is \$30.00 per ton and the conversion factor is 20. With grain at \$40.00 per ton the price of butterfat produced by a cow whose conversion factor is 20 must exceed 52 cents in order to get profitable returns for the grain feeding.

This table will repay careful study. It will be noted that when grain is as high as \$35.00 or \$40.00 per ton, its use in the ration as a supplement to alfalfa hay will be economically justifiable only when fed to the most efficient cows. Even when the price of grain is as low as \$30.00 per ton its use would not be justified for feeding to cows having a conversion factor higher than 24 when butterfat is selling within its usual range.

Footnote Table 2—Cost in Cents of Increased Butterfat Production Resulting From Feeding of Grain. Cow Efficiency and Grain Price Variable

Conversion factor of Cow	Price of Grain Per Ton							
	\$25	\$30	\$35	\$40	\$45	\$50	\$55	\$60
14	23	27	32	36	41	45	50	54
16	26	31	36	41	46	51	56	61
18	29	35	41	46	52	58	63	69
20	32	38	45	52	58	64	70	77
22	35	42	50	57	64	70	77	85
24	38	46	54	62	70	77	85	92
26	42	50	59	67	75	83	92	100
28	45	54	63	72	81	90	99	108
30	48	58	68	77	87	96	106	115
Based on 77.4% total digestible nutrients in grain mixture								
Factor × Cost of Grain in cents per Pound = Feed Cost of Increased								
.774 Butterfat Production.								

To Establish the Conversion Factor When Weight of Roughage Fed is Unknown

—It is of very great importance to be able to find the feed cost per pound of butterfat produced. This is especially true when grain is fed, for it is very easy to feed grain at a loss as has been shown in the foregoing discussion. In order to use Footnote Tables 1 and 2 it is necessary to know the conversion factor for each cow. The most accurate method would be to calculate the pounds of total digestible nutrients fed during the year and divide this by the pounds of butterfat produced, but this would require a knowledge of the weight of all roughages and concentrates fed.

For farmers such a procedure is impracticable, but there is a simple method of estimating the conversion factor that will give results that are approximately correct. The object is to find the conversion factor for each cow so as to pick out those that are efficient enough to return profits from grain feeding at current market prices for grain and butterfat.

Feeding records indicate that dairy cows consume about five times their weight of total digestible nutrients per year in the form of roughages.* In addition to this they can consume an additional amount of digestible nutrients fed to them in the form of concentrates.

Each pound of concentrates fed adds about three-fourths of a pound of digestible nutrients, but the lessened amount of hay eaten results in a net increase in digestible nutrients of only about one-half pound for each pound of grain fed. To estimate the conversion factor proceed as follows:

1. Multiply normal weight of cow by 5.
2. Add to this one-half the number of pounds of grain fed to her during the past year.
3. Divide the results by the pounds of butterfat produced during the year. The result is the estimated conversion factor for that cow.

*This factor is approximately correct when an unlimited ration of good quality alfalfa is fed. It is probably too high when a nonlegume hay or alfalfa of poor quality is fed.

Examples Showing How to Pick Cows That Pay a Profit on Grain Feeding

Assume that grain cost \$35.00 a ton.

Example No. 1—	
Cow Weights	1,400 lbs.
Grain fed past year	600 lbs.
Butterfat produced	260 lbs.

$$\begin{array}{r} 5 \times 1,400 = 7,000 \\ 600 \div 2 = 300 \end{array}$$

$$7,000 \div 260 = 28 \text{ Conversion factor.}$$

Example No. 2—	
Cow weights	1,300 lbs.
Grain fed past year	1,000 lbs.
Butterfat produced	438 lbs.

$$\begin{array}{r} 5 \times 1,300 = 6,500 \\ 1,000 \div 2 = 500 \end{array}$$

$$7,000 \div 438 = 16 \text{ Conversion factor.}$$

Example No. 3—	
Cow weights	1,200 lbs.
No grain fed	
Butterfat produced	330 lbs.

$$\begin{array}{r} 5 \times 1,200 = 6,000 \\ 6,000 \div 330 = 18 \end{array}$$

Conversion factor.

Reference: Nevada Agricultural Experiment Station Bulletin No. 119, Pages 5, 6, 7, 8, 9, 11, 14, 16, 17, 18, 19 and 20, Tables 1, 2, 4, 7, 8 and 9, August 1930, "Feeding Experiment With Dairy Cows," Reno Nevada.

Suggestive—How much hay was saved by each pound of grain fed to Group II? For each pound of grain fed to Group III?

Use Form 5 suggested on page 29 for determining relative economy of each of the feeding methods.

HOW MUCH COTTONSEED MEAL MAY BE SAFELY FED DAILY TO DAIRY COWS?

Until recent years, there has been a great deal written about cottonseed meal poisoning. Experiments were conducted in many states which showed cottonseed meal produces fatal results. However, within recent years some experiment stations have obtained results which indicate that cottonseed meal is poisonous only when fed under certain condition.

I

The Okiahoma Agricultural Experiment Station began feeding cottonseed meal to dairy calves at 30 days of age, fed it to them through the growing period and until they had completed one lactation period. Records are available on four cows that have been fed on cottonseed meal from 30 days of age through the second lactation period. A commercial grade of cottonseed meal containing 43% total crude protein purchased on the open market has been used during the entire experiment. During the first three years, 25 purchases were made from three dealers.

Consumption of Cottonseed Meal by Dairy Calves. In May, 1927, a long-time feeding experiment was begun to study the effects of cottonseed meal on growth, reproduction and production of dairy cattle. Due to the limited number of animals which have been used in this study and the length of time necessary to carry animals from birth through several periods of gestation and lactation, final conclusions may not be drawn from the results obtained to date. On account of the importance of the use of cottonseed meal in dairy rations the results obtained thus far may be of considerable interest and value to dairymen and other livestock men.

Cottonseed meal for Calves. Twenty-eight grade Jersey calves have been raised to the age of six months during the five years on milk and a basal ration of cot-

tonseed meal and prairie hay. Only four calves started in the earlier groups have died but in no case did cottonseed meal seem to be the cause of the deaths.

The calves used in this phase of the project were fed whole milk the first six weeks and skim milk until they reached the age of six months. When they were several weeks old and showed a desire for other feeds they were offered cottonseed meal and prairie hay. The amount of cottonseed meal offered the first two in groups in which 11 calves were raised was limited to one-half pound of meal daily for each 100 pounds liveweight until they were six months old. After that age one pound of meal daily for each 100 pounds live weight was allowed. Since this ration did not enable the calves to make normal growth later groups were fed as much cottonseed meal and prairie hay as they desired. Seventeen calves raised in this manner have developed in a very satisfactory manner for their gains in weight have approached and in some cases even exceeded those of normal Jerseys. The average daily consumption of cottonseed meal per calf for these 17 animals was 1.1 pounds, 2.8 pounds, 5.0 pounds and 6.0 pounds during the third, sixth, ninth and twelfth months, respectively. This is about four times as much meal as the first 11 head consumed during the third and sixth months and three times as much as they consumed during the ninth and twelfth months.

In addition to the animals started as calves, a group of eight yearling heifers was purchased in the spring of 1928 and fed the same experimental rations. All animals used in this experiment have always been confined in a dry lot.

Milk Production of Animals Grown On Cottonseed Meal Ration. The average milk records of the mature animals are shown in Table 24.

Table 24 Milk Production of Cows Grown on Cottonseed Meal Rations at Stillwater, Oklahoma.

Number of Animal	Days In Milk	Milk Pounds	Fat Pounds	4% Fat Corrected Milk
FIRST LACTATIONS				
Ave. 12 Cows	314	5086.1	261.28	5953.61
SECOND LACTATIONS				
1	266	3171.5	154.38	3584.30
2	305	4144.6	192.28	4542.04
3	322	4906.8	287.41	6309.87
4	309	6513.8	337.29	8414.87
Average 4 Cows	301	4706.7	255.34	5712.78
Same Cows first lactation	285	4364.1	229.50	5188.13

The Effect of Cottonseed Meal On Milk Production. The allowance of cottonseed meal was usually reduced a few days after calving and then gradually increased until each animal received all the meal she would consume. In most cases maximum consumption was reached during the second month of lactation and then continued with little change for periods ranging from 4 to 8 months. On the average 10.8 pounds of cottonseed meal and 13.4 pounds of prairie hay were consumed daily by each of the 12 animals which have completed one lactation period.

In order to put cottonseed meal to a very crucial test and one in which the effects of cottonseed meal feeding would not be clouded by the beneficial influences of either a good grain mixture, a good roughage or succulent feeds such as silage or pasture the animals have at all times been kept in a dry lot and always supplied a basal ration of cottonseed meal, prairie hay, salt and water. Calves were fed milk only during the first six months.

By "4 per cent fat corrected milk" is meant the amount of 4 per cent milk equivalent to the amount of milk actually produced.

The history of animal No. 5, one of the oldest animals in the experiment, includes some very interesting records. Some of these are shown in Table 25.

Table 25—Feed Consumption Cow No. 5

Period	Total Feed Consumed			Av. Daily Feed Consumed	
	No. of Days	Cottonseed Meal Pounds	Prairie Hay Pounds	Cottonseed Meal Pounds	Prairie Hay Pounds
First gestation	261	1824.9	2551.5	7.0	9.8
First lactation	310	3930.9	4393.4	12.7	14.2
First dry period	78	566.0	942.0	7.1	12.1
Second lactation	309	4637.5	3864.8	15.0	12.5
Second dry period	68	805.5	886.6	11.8	13.0
Third Lactation (To date)	150	2534.8	2072.1	16.9	13.8
TOTAL	1176	14299.6	14710.4	12.2	12.5

The average of the last 12 monthly weights of cow No. 5 is 831 pounds, indicating that she is only medium in size. She was bred the first time on April 15, 1929. Since this day, in a period of about three and one-third years, she has consumed 7.1 tons of cottonseed meal, has conceived to the first service three different times and has dropped three living calves, all which were raised. In the first two lactation periods she has produced 315.28 and 387.29 pounds of butterfat respectively. In her third lactation she reached a maximum daily consumption of 21 pounds of cottonseed meal and for 35 consecutive days consumed an average of 20 pounds of meal daily. Production of milk and butterfat for the first 150 days of her third lactation exceeded the yields made during the same periods in the first and second lactation.

Cow No. 5, a grade Jersey, was born May 30, 1927. During her life time she has already consumed more than eight tons of cottonseed meal. She has been fed cottonseed meal and prairie hay since she reached the age of 30 days. After being weaned from milk at the age of six months, cottonseed meal, prairie hay, salt and water have constituted her entire ration. In her first three lactation periods she has produced 316, 387 and 417 pounds of butter fat respectively, in 310, 309 and 311 days.

Effect of Cottonseed Meal on Reproduction; Breeding Record. In general it has been the plan to breed heifers at the age of 15 to 17 months or when they reach a weight of 500 to 550 pounds. Nineteen animals, including one heifer that was bred shortly before she was put on the experimental ration have passed through the first gestation period. The average daily ration per animal during the first gestation period consisted of 6.0 pounds of cottonseed meal and 10.6 pounds of prairie hay.

Eighteen animals that were in the experiment before being bred have calved once, nine of these twice and three of these three times. Twenty-one services were required for the 18 first conceptions, 13 for the calves resulting from the second gestation period and three for the calves of the third gestation. The three cows which have calved three times have conceived to the first service each time. A second service was necessary in only 7 of these 30 cases. On the average there have been 1.2 services for each conception. Difficulty has been encountered in two cases in which cows after calving once, did not conceive again although they were bred frequently. One of these developed very masculine characteristics and was sold, the other although bred five times is still not with calf. In one group of seven heifers reaching breeding age during the past year four heifers have each been bred more than three times. To date two of these have not conceived.

Effect of Cottonseed Meal on Reproduction; Calving Record. In all cases parturition was normal and rapid and no case was any assistance given or needed. In 30 cases of parturition, placental membranes were retained in only two. In all other cases placental membranes were retained less than half an hour after calving. Udders in all cases have developed normally. Very little of the usual congestion that is often observed in first-calf heifers has occurred.

Due to the condition of one aborted fetus its sex was not determined. Of

the other 30 calves, 22 were males and 8 females. The range of the gestation periods resulting in the birth of living calves extended from 261 to 289 days. The average length of 25 gestation periods in which the calf was carried 260 days or more is 280 days. The average birth weight of these 25 calves is 50.7 pounds. Of the 31 calves from cows fed the basal ration during the entire gestation period and including one heifer fed the same ration for the last 187 days of the gestation, 17 were raised, 5 died from toxemia due to colon infection, 5 were dead at birth and 4 died from other causes, including failure of heart valves to function, misplacement of both hip joints during fetal development, and chilling due to exposure immediately after birth. Since more than a dozen calves born in the general dairy herd, not fed experimental rations, died from the condition which was diagnosed as toxemia due to colon infection, the experimental ration apparently was not responsible for these losses.

Effect of Cottonseed Meal On Reproduction; Most Difficulty With a Particular Group. Six of the 14 calves lost thus far were the progeny of 8 heifers which were started on the basal ration when approximately a year old. These heifers, Lot 3, were purchased in the spring of 1930 because it was impossible to start a group of calves during the previous year. It was also hoped that the addition of a group of yearling heifers might furnish some information concerning any likelihood that calves accustomed gradually, to consume large quantities of cottonseed meal might establish a "tolerance" for any injurious effects of cottonseed meal. As far as is known none of these animals was ever fed any appreciable amount of cottonseed meal before they were secured for this experiment. Feed consumption and gains in live weight of these animals have compared favorably with those of any other lot at corresponding ages.

It is rather interesting to note that practically all of the breeding troubles experienced in this experiment have occurred within this lot of very thrifty and rapidly growing animals. Two of the three positive reactions to the agglutination test and three of the four abortions occurred in this lot. Number 21, another heifer in this group, produced a living calf at the end of 270 days of gestation which was weak and unthrifty until cod liver oil was added to its ration. Animal No. 23 produced a 31-pound calf at the end of a 283-day gestation period which was blind and unable to stand or walk. The eyes of this calf, in every way, resembled the condition which has been observed in five cases in which dried beet pulp has been substituted for prairie hay in the basal ration. A week after birth, the eyes gradually became normal but the calf died rather suddenly when 13 days old. A post mortem examination showed that the left lobe of the lung had never functioned and that both hip joints were misplaced during fetal development. The calving record of these heifers indicates that a ration of cottonseed meal and prairie hay which is adequate for animals that are making only a fair rate of growth, may be inadequate when the individuals are subjected to the combined influences of rapid growth and reproduction. It is also possible that the inferior grade of prairie hay fed during this period may have been involved. This phase of the work will be repeated with additional animals.

Reference: Oklahoma Agricultural Experiment Station 1926-30 and 1930-32 Reports, Pages 152, 153, 154, 155, 156, and 157, 1930-32 Report, Stillwater, Oklahoma.

Suggestive. From the results of the experiment, what do you think of the probability of cows becoming poisoned from cottonseed meal when fed on it from 30 days of age with plenty of good quality prairie hay, salt and water?

II

Experiments have been run with 10 mature cows at the United States Dairy Experiment Station at Beltsville, Maryland, to determine the cause of cottonseed meal poisoning. It will be noted that Cow No. 91 was fed cottonseed meal from

Leland, Mississippi, Dallas, Texas, and South Carolina to determine the relative toxicity of meal made in various parts of the cotton belt. After all these failed to produce the symptoms of poisoning, her roughage was changed to wheat straw, instead of alfalfa hay and either pasture of silage.

Table 26—Feeding Cottonseed Meal To Dairy Cows at Beltsville, Maryland

No.	Kind of Cow	Roughage Fed	Number Days Fed	Lbs. Meal Per Day	Results
91.....	Holstein, Sterile grade	pasture and alfalfa hay or silage & alfalfa hay	69**	16	No harmful effects.
		wheat straw	286*** 84 lbs.	10	No harmful effects. post-mortem revealed no unusual condition.
97.....	Holstein, Sterile grade	pasture, silage, alfalfa hay	84**	10	A very obvious improvement in her condition.
82.....	Holstein, Grade (Difficult breeder)	pasture, silage, alfalfa hay	137	10	She failed to conceive, but her health remained good.
A29.....	Jersey heifer, supposedly sterile	no statement	42	4	Five months after feeding started, she conceived, carried calf full time and conceived again on first service. The feeding of meal was discontinued after she was first pronounced pregnant.
64.....	Both grade and Holsteins	pasture, alfalfa hay, silage	16 mo 17 mo	10	Began feeding meal to cow 64 when she had been pregnant 148 days. Began feeding A-2 when she had been pregnant 16 days. Both dropped full time normal calves. Flesh and health of cows good throughout test. A-2 conceived 7½ months after calving. Cow 64 had adhesions around Fallopian tubes which prevented conception.
468.....	Both dry, ste-and rile	timothy hay or silage or both	122	10*	No bad effects were observed, but they remained sterile.
279.....					
442.....	Sterile	timothy hay wheat straw	165 39	10	No bad effects observed. Sterility persisted.
490.....	Sterile	silage	180	10	Her health remained good and she conceived in 4½ months.

*Cow 468 actually ate about 8 pounds of meal per day.

**Cottonseed meal from Leland, Mississippi.

***72 days' feeding of this cottonseed meal was from Dallas, Texas, and 214 days' feeding was from South Carolina. All of the 84 pounds was from South Carolina.

Reference: United States Department of Agriculture, Miscellaneous Publication No. 130, Pages 7 and 8, January, 1932. "Feeding and Management Investigations at The United States Dairy Experiment Station at Beltsville, Maryland, 1930 Report." Washington, D. C.

Suggestive. From the results of these tests what do you think of the danger from cottonseed meal poisoning when 10 pounds or less are fed per day with plenty of good grade roughage?

III

The Effect of Heavy Cottonseed Meal Feeding Without Roughage at East Lansing, Michigan.

Until recently, gossypol has been exploited as the most probable cause of cottonseed meal injury in cattle. However, a review of the literature revealed very few cases of cottonseed meal injury in cattle where plenty of roughage of good quality was fed.

This suggested the possibility that the cases of so called "cottonseed meal in-

jury” among cattle might be due to some deficiency in the ration, since similar symptoms were observed at the Michigan Agricultural Experiment Station among calves fed concentrates alone. Consequently a preliminary experiment was started in order to study this relationship. Two lots of two calves each were used.

The animals in lot 1, C43 and C47 received cottonseed meal as the principal source of protein while those in lot II, C44 and C45, received corn gluten meal and corn distillers’ grain. Both groups received corn and oats and wheat straw ad libitum. Salt was placed before the animals at all times. Skim milk was fed to 180 days of age. These animals received an adequate ration up to the time they were placed on experiment which was 90 days of age. Stiffness and swelling around the hocks were observed in all four animals. C43, which received cottonseed meal, had a convulsion at 287 days of age. Seven days later another convulsion was observed. This calf also had diarrhea from time to time. It died at the age of 340 days. C47 which also received cottonseed meal, died at 275 days of age. This animal did not become blind or manifest tetany although the ration fed injured its health.

Calves C44 and C45, which were fed a ration free from cottonseed meal, became blind. C44 became blind at 347 days of age and C45 at 293 days of age. Neither of these calves died from the effects of their ration but their condition was so poor that C45 was killed and the ration of C44 changed. The results with these animals indicate that the symptoms of so called “Cottonseed meal injury” were due to a lack of a factor or factors carried by hay and not due to gossypol poisoning.

In order to determine the effects of heavy cottonseed meal feeding along with corn silage and hay of good quality a long time feeding experiment was begun in 1925. It was planned to continue this experiment over three generations in order to bring out if possible the injurious effects of cottonseed meal.

Two lots of five Holstein heifers each were used in the first generation. Animals in lot I, G1, G3, G5, G7, and G9, received cottonseed meal as the principal source of protein. Those in lot II, G2, G4, G6, G8, and G10, received linseed oil meal as the principal source of protein. The latter lot was used as a check since linseed meal is recognized as safe protein concentrate to use as a supplement for growing cattle and milking cows. The animals in both lots were placed on experiment at 90 days of age. Skim milk was fed until 150 days of age to both lots. They were fed throughout the experiment all the timothy hay and corn silage they would clean up. Bone meal was fed as 2 percent of the protein concentrate to both lots of animals. The animals had free access to salt to 18 months of age, after which salt was added as 1 per cent of the concentrate.

Table 27. The Effect of Heavy Cottonseed Meal Feeding With Good Roughage at East Lansing, Michigan.

Lot No.	Av. Daily Lbs. C. S. M. or L. O. M. Fed	No. Services for Con- ception	Birth Weight of Calf	Pounds Milk Produced	Pounds Butterfat Produced
Six months to first calving					
1 Cottonseed meal	2.3	1.2	82	.....	.....
2 Linseed oil meal	2.9	1.8	84	.....	.....
First to second calving					
1 Cottonseed meal	6.8	1.2	82	9,831	345.5
2 Linseed oil meal	7.7	1.8	84	8,204	289.7
Second to third calving					
1 Cottonseed meal	7.5	1.6	84	11,322	382.9
2 Linseed oil meal	9.3	2.6	80*	10,171	374.0
Third to fourth calving					
1 Cottonseed meal	8.4	2.4	90	12,444	432.4
2 Linseed oil meal**	9.4	1.2	90***	10,771	371.7

*One cow in this group aborted a 35 pound calf and died later.
 **Average of only 4 cows.
 ***The weights of the calves in this group varied considerably. One weighed only 64 pounds while another weighed 108 pounds.

The cottonseed meal and linseed meal fed in this investigation were purchased on the open market. Up to first calving the animals in lot I received sufficient cottonseed meal in their ration to meet the Armsby requirement for protein. Since a slightly smaller amount of cottonseed meal was fed than linseed meal in order to feed the same amount of protein, a small amount of yellow corn was fed to Lot I to bring the energy up to the same level as contained in the larger amount of linseed meal. The protein in the corn, corn silage, and timothy hay was considered as excess protein. The animals in lot II were fed similar to those in lot I except old process linseed meal replaced cottonseed meal in the ration.

After first calving the animals in both lots were fed protein according to the upper limits of the Morrison feeding standard from cottonseed meal in lot I and linseed meal in lot II. The protein in the other feeds was excess protein. Since linseed meal contained less protein than cottonseed meal, it was necessary to feed more linseed meal than cottonseed meal.

The different batches of cottonseed meal used in this investigation during the first three years were tested to determine whether or not the cottonseed meal would produce so called "Cottonseed meal injury" when fed with an inadequate ration. The first batch which was fed during the first nine months was the same as that fed to C43 and C47. The second batch was fed a Holstein bull calf along with wheat straw, corn, oats, bone meal and salt. It was placed on experiment at 96 days of age. Skim milk was also fed to 150 days of age. Death occurred as a result of a convulsion at 301 days of age. The third batch was fed to C80, a Holstein bull calf, which was placed on the same ration as that fed, C70, except the cottonseed meal was of a different lot, at 94 days of age. This animal died at 361 days of age with the characteristic symptoms of cottonseed meal injury. It was emaciated, scoured badly, and became partially blind about six weeks before death.

It is evident that the cottonseed meal used in this investigation during the first three years of the experiment produced so called "cottonseed meal injury" in calves when fed with a ration deficient in the factors carried by hay. However, when hay and silage were fed along with cottonseed meal, corn, bone meal, and salt, entirely different results were produced, as presented in Table 27.

Health. There has been but very little difference in the health of the two lots of animals thus far. The animals which were fed heavily on cottonseed meal failed to show swollen joints, stiffness, blindness, or convulsions, which are the symptoms of cottonseed meal injury in cattle. It is apparent that the symptoms of so called "Cottonseed meal injury" are not manifested when the ration is made adequate.

Hide and Hair. It is common opinion among livestock feeders that the feeding of linseed meal to cattle results in a sleeker coat of hair and a more pliable hide than when cottonseed meal is fed. Ten recognized judges of dairy cattle attempted to differentiate between the animals fed linseed and those fed cottonseed meal. The difference between the sleekness of coat, pliability of hide, and condition of the animal was so small that the judges were unable to distinguish between the two lots of heifers. The double thickness of hide was measured from time to time by a pair of calipers. The measurement was taken at the mid-section of the last rib. No difference in double thickness was observed between the animals fed linseed and those fed cottonseed meal.

Lice infestation depends to some extent on the health of the skin. When the sebaceous glands secrete sufficient oil to keep the hair oily, lice can not exist. The oil clogs up the breathing mechanism of the lice, therefore, any feeding regime which keeps down lice infestation probably does so by increasing the secretory activity of the sebaceous glands of the skin. In this experiment there

was no appreciable difference in lice infestation between the linseed and the cottonseed meal fed animals.

Effect of Heavy Cottonseed Meal Feeding on Reproduction and Milk Production. The only abortion occurring this far in this investigation was that of G8 which received linseed meal. G8's second calf was carried 240 days and weighed only 35 pounds. It was weak and died 8 hours after birth. This abortion cannot be attributed to the effects of the ration.

The table shows an advantage in milk and fat production in favor of the animals fed cottonseed meal. However, this difference is probably due to difference in inheritance for production.

During heavy production as much as 17.3 pounds of cottonseed meal was fed daily for several months without any noticeable detrimental results.

Rate of Feed Passage. When this investigation was started it was the common opinion of investigators and feeders of livestock that cottonseed meal was constipating when fed to cattle. Cottonseed meal was often fed to cows on pasture to counteract the laxative effect of the pasture. It was also frequently fed with linseed meal to counteract the laxative effect of linseed meal.

The rate of food passage through the digestive tract of the two lots of animals was studied. A fat soluble dye, Sudan III, was fed as a marker. Samples of feces were then collected from each passage and the time noted. These samples were dried in an oven. One gram of the dried feces was extracted with 10 cc. of ether. The color of this extract from the first sample of feces was green, due to the chlorophyll from the hay. The red color of the red dye superimposed upon the green produced a light brown to brownish red color. The average initial appearance of the dye in the feces was approximately 15 hours in both groups. The final appearance of the dye in the feces was fifty to sixty hours in both groups. In other words there was no appreciable difference in the rate of food passage through the digestive tract of the animals receiving cottonseed meal or linseed meal.

Consistency of Feces. The consistency of the feces of the two lots was also determined. The consistency of different feces has usually been measured by observing the physical appearance. In this investigation the following mechanical method was used: The feces samples were taken immediately after evacuation. A 6-inch evaporating dish was filled with the fresh feces and leveled off with a smooth stick. A wooden ball with graduations upon its circumference was gently placed in the center of the feces in the evaporating dish. Each graduation was called a degree. A 500-gram weight was placed upon the top of the ball which was flattened on top. The distance which the ball indented the feces was determined by the graduations. Hence, the softer the feces the further the ball sank and the greater the degrees and vice versa. The determinations were made about the same time each day. The results showed very little difference in the consistency of the feces of the two groups even though the cottonseed meal cows received 7.8 to 9.0 pounds of cottonseed meal daily and the linseed meal group received from 6.0 to 12.6 pounds of linseed meal daily.

Since in our long time experiment silage was fed along with cottonseed meal, we thought that silage may have been responsible for our results. Consequently two other short time experiments were carried out with cattle fed a ration of timothy hay and grain without silage. In one experiment cottonseed meal and linseed meal were fed at 9 pounds per day by the reversal system. There was no difference in the softness of the feces when cottonseed meal and linseed meal were fed.

In other experiment a lower level of cottonseed meal and linseed meal was

fed since there was a possibility that high levels of cottonseed meal might stimulate the intestines. Again there was no difference in the consistency of feces when cottonseed meal and linseed meal were fed. Our results show conclusively that cottonseed meal is not constipating when fed to dairy cattle with or without silage.

Cottonseed Meal and Udder Infection. Many dairymen believe that heavy feeding of cottonseed meal increases the susceptibility of dairy cows to udder diseases, especially mastitis. However, our results indicate that heavy feeding of cottonseed meal does not increase udder troubles. There was no significant difference between the cottonseed meal lot and the linseed meal lot in this respect.

Reference: The Jersey Bulletin and Dairy World, pages 1553 and 1572, "Cottonseed Meal as a Feed For Dairy Cattle," October 26, 1932, Indianapolis, Indiana.

Suggestive. Under what conditions did cottonseed meal poisoning occur in these experiments? Under what conditions did it fail to occur? Under the conditions when it failed to occur, how much cottonseed meal may be safely fed per day?

WHAT KIND OF ROUGHAGE SHOULD BE FED TO DAIRY COWS?

In working through some of the foregoing experiments, it may be found that plenty of roughage helps to make the dairy ration more economical. The question naturally arises, "What kind of roughage should be fed?" Some experimental evidence is offered here that may help to solve the problem.

I

A Comparison of Legume and Grass Hays When Fed in Combination with Concentrates from Three Sources at State College, Mississippi. These Concentrates to be the Cheapest Available Based Upon the Prices for the Past Five Years.

In this project soybean hay was used as the legume and Johnson grass as the grass hay. Three lots of four cows each were used in the experiment. The reversal system of feeding was adopted. In determining the three cheapest concentrates, prices were obtained for the past five years on the concentrates generally used for feeding dairy cows in Mississippi. The cheapest were found to be in order named, cottonseed meal, wheat bran, and corn chops. A grain ration was made consisting of 100 pounds of cottonseed meal, 100 pounds of wheat bran, and 100 pounds of corn chops and this was fed at the rate of approximately one pound to each three pounds of milk produced. In addition, the cows in all of the lots, each received 20 pounds of sorghum silage and one-half pound of blackstrap molasses daily. Lot 1, during the first and third periods of four weeks each, received soybean hay and during period 2, Johnson grass hay. Lot 2, received Johnson grass hay during the first and third periods and soybean hay the second period. Lot 3, received Johnson grass hay throughout the three periods. Only the last three weeks of each period are used in making the comparison. The hay for all lots was fed ad libitum for the purpose of determining the greatest amount of each of the hays the cows would consume. A careful check was made of the amount actually eaten by each lot.

Table 28. Johnson Grass Hay vs. Soybean Hay Fed to Dairy Cows at State College, Mississippi.

(Figures given as averages per cow)

Soybean Hay	Gain or loss in live wgt.	Milk lbs.	Fat lbs.	Mixed Feed	Mo- lases	Soy B. Hay	J. G. Hay	Hay Refused	Hay Eaten	Silage
Lot 1, Period I	-42	1143.2	55.09	399	42	1584	-----	518.8	1065.7	1680
Lot 2, Period II	-19	1179.8	62.30	399	42	1565	-----	382.0	1173.0	1680
Lot 1, Period III	-2	1063.0	52.16	399	42	1565	-----	365.2	1199.8	1680
Av. per cow per day	-63	3386.0	169.55	1197	126	4704	-----	1265.5	3438.5	5040
	-24.25	13.4	0.67	4.8	0.5	18.7	-----	5.1	13.6	20
Johnson Grass										
Lot 2, Period I	42	1210.5	61.88	399	42	-----	1580	299.7	1280.3	1680
Lot 1, Period II	-16	1062.1	51.77	399	42	-----	1555	261.1	1293.9	1680
Lot 2, Period III	104	1079.1	57.28	399	42	-----	1565	261.2	1303.8	1680
Av. per cow per day	130	3351.7	170.93	1197	126	-----	4700	822.0	3878.0	5040
	.52	13.3	0.68	4.8	0.5	-----	18.7	3.3	15.4	20
Johnson Grass										
Lot 3, Period I	37	1267.7	57.27	399	42	-----	1584	389.2	1194.8	1680
Lot 3, Period II	-29	1161.5	54.70	399	42	-----	1555	420.9	1134.1	1680
Lot 3, Period III	133	1114.0	52.57	399	42	-----	1565	393.1	1171.9	1680
Av. per cow per day	131	3543.2	164.54	1197	126	-----	4704	1203.2	3500.8	5040
	.52	14.1	.65	4.8	0.5	-----	18.7	4.8	13.9	20

Reference: J. S. Moore and W. C. Cowsett, Dairy Research Workers, Mississippi Agricultural Experiment Station, State College, Mississippi.

Suggestive: On which roughage ration did the cows gain more weight? On which did they produce more milk? More Butterfat? When the cost of each ration is worked according to Form 5 Page 29? Which is more economical?

II

Table 29. A Comparison of Various Hays for Dairy Cows at State College, Mississippi

Period and Hay Used	Milk Pro- duced (Lbs.)	Butterfat Produced (Lbs.)	Feeds (Lbs.)	Consumed		Gain or Loss in Live Wt.	Feed per 100 Lbs. Milk		Feed per 1 lb. of Butterfat	
				Hay	Silage		Hay	Silage	Hay	Silage
2 Soybean hay	2740	69.2	1080	2200	510	-100	39.4	80.3	15.6	31.8
1 and 3 Alfalfa hay	2756	65.0	1080	2200	510	+35	39.2	79.8	16.6	33.8
	Soybean Hay Versus Lespedeza Hay—Begn November 6, 1922, 3 Jersey and 2 Ayrshire Cows									
2. Lespedeza hay	2435	95.4	1280	2000	1180	+58	52.56	82.13	48.46	13.31
1 and 3 Soybean hay	2544	99.9	1280	2000	1180	-146	50.31	78.01	40.38	12.81
	Soybean Hay Versus Lespedeza Hay—Begn November 6, 1922—2 Jersey and 2 Ayrshire Cows									
2 Lespedeza Hay	1864	74.0	796	2370	556	-121	42.7	127.1	29.8	32.0
1 and 3 Alfalfa hay	2103	80.5	940	2450	565	-41	44.7	111.7	11.7	30.4
	Mammoth Yellow Versus Laredo Soybean Hay—Begn December 22, 1924—3 Jerseys and 2 Ayrshire Cows									
2 Laredo Hay	2351	106.3	1280	2000	1180	-84	54.4	85.1	50.2	18.8
1 and 3 Mammoth Yellow Hay	2507	110.2	1280	2000	1180	-124	51.5	79.8	47.1	18.1

Soybean Hay vs. Alfalfa Hay: This test was made to determine the relative feeding value of soybean hay as compared with alfalfa hay. There were five cows in the lot and they were fed for three 30-day periods, the first ten days of each period being allowed for changing feeds, and the last 20 days only of the period being used in the experiment proper. Alfalfa was fed during the first and third periods and soybean hay was fed the second period. The basal grain ration consisted of 50% corn chops, 25% wheat bran, and 25% cottonseed meal by weight. In addition to the hay and grain, the cows received corn silage. There were three Jerseys and two Ayrshire cows with an average of 820 pounds live weight.

While the cows were on the alfalfa hay ration, they ate 88.24% of the alfalfa given. When on the soybean hay ration, they ate 83.15% of the soybean hay.

Soybean Hay vs. Lespedeza Hay: In making this test, five cows were used. The periods were the same as for the test with alfalfa—the first ten days of each period being used as a transition period and the last twenty days for the test proper. The grain in this test consisted of a mixture containing 300 pounds cottonseed meal, 200 pounds wheat bran, 100 pounds hominy feed, 100 pounds rice bran, and 100 pounds rice polish. In addition and included in the grain ration, each cow received three pounds per day of blackstrap molasses.

Three of the five cows lost in weight while getting lespedeza hay and one cow gained in weight on the soybean hay. The hay refused during the soybean period was 18.84% greater than when the cows were fed lespedeza hay.

Lespedeza vs. Alfalfa Hay: Another test was also made to compare the feeding value of lespedeza and alfalfa hays, using the same number of cows, periods, and basal rations as in the Soybean vs. Alfalfa hay test.

Mammoth Yellow vs. Laredo Soybean Hay: Five cows were used for three periods of thirty days each as in the preceding tests. The grain and silage were the same for all periods—the grain mixture being that used for cows reported in the soybean vs. lespedeza hay test.

Reference: Mississippi Experiment Station Bulletin No. 235, pages 5, 6, 7, 8 and 9, "Soybeans for Dairy Cows," State College, Mississippi, June, 1926.

Suggestive: In each of these tests on which kind of hay did the cows produce more milk? More butterfat? Which maintained the body weight of the cows better? Which is more economical in acreage required?

III

Table 30. Ground versus Unground Soybean Hay for Dairy Cows at State College, Mississippi.

Lot	Feed Used First Period	Milk Produced	Butterfat Produced	Feed Consumed Hay	Silage (Lbs.)	Grain	Gain or Loss in Live Weight
1	Experiment lot						
	Soybean hay	2393	105.6	1280	2000	1180	-62
2	Control lot						
	Soybean	2593	103.5	1280	2000	1180	-62
	Second Period						
1	Experiment lot						
	Ground soybean hay.....	2454	104.1	1280	2000	1180	243
2	Control lot						
	Soybean hay	2423	96.2	1280	2000	1180	-33

Ground vs. Unground Soybean Hay: One of the difficulties encountered in feeding soybean hay in sufficient quantities to reduce the grain feed to a minimum has been our failure to get the cows to eat enough of the hay to supply their needs. In order to determine whether or not grinding the hay would overcome this difficulty and at the same time be economical, tests were made as given in table 30. In this test the reversal method was not used. Two lots of five cows each containing 2 Ayrshire and 3 Jerseys were placed on test. Lot 1 was fed dur-

ing the first period and Lot 2 was fed during the first and second periods, on unground mammoth yellow soybean hay, while during the second period, Lot 1 received ground soybean hay.

It will be noted that where both lots in period 1, received the same feed, the cows in the control lot gave 200 pounds more milk and 2.14 pounds less fat than did Lot 1; while in period 2, the lot receiving the ground hay gave 31 pounds more milk and 7 pounds more fat than did the lot receiving the unground hay. The most marked difference, however, is the gain or loss of live-weight during period 2. Lot 1 gained 243 pounds in live-weight and Lot 2 lost 33 pounds. This can probably be accounted for in part, at least by the fact that in this period the cows in Lot 1 ate 74.06% of the hay and those in Lot 2 ate only 62.97%. These cows received a basal grain mixture throughout both periods consisting of 300 pounds cottonseed meal, 200 pounds wheat bran, 100 pounds each of hominy, rice bran, and rice polish; and in the grain ration and considered a part of it were three pounds of blackstrap molasses fed each cow daily. As a succulent feed, corn silage was used.

Reference: Mississippi Experiment Station Bulletin No. 235, Pages 9, 10, and 11, "Soybeans for Dairy Cows," State College, Mississippi, June, 1926.

Suggestive. According to the cost of grinding roughage in your community, would the extra milk or butterfat pay for the cost of grinding?

WHAT NUTRITIVE BENEFITS MAY BE EXPECTED FROM PASTURE?

I

In March 1934, the dairy herd of Mississippi State College was kept in the barn at night and in the pasture during the day. This pasture furnished little grazing, but was probably as good as the average permanent pasture in this section for the month. The cows were fed a full ration not counting that provided by the pasture. On April 1, the herd was turned on a twelve acre pasture. No animals had been on this during the winter months. The twelve acres were grazed for seven days. The following table gives the results for the week before and the week on good pasture.

Table 31. Results of Grazing A Herd of 80 Dairy Cows in Good Pasture for One Week at State College, Miss.

	Week Ending March 31	Week Ending April 7
No. of Cows	90	90
Cows In Milk	80	80
Feed Eaten	Amount	Amount
Johnson grass hay, lbs.	3780	
Sorghum silage, lbs.	25200	12600
Grain, lbs.	2500	2520
Milk produced	8007	9748
Butterfat, lbs.	400.4	468.05

The twelve acres will be grazed several times during the summer, and later on the saving in feed will be much greater as no silage will be required and the grain can be reduced, as a good pasture will provide sufficient feed for maintenance and for the production of twelve pounds of milk testing 5% butterfat.

During the summer of 1922 five cows on good pasture were compared with five cows on poor pasture for a period of 168 days. This test was repeated in 1925 with two lots of four cows each for a period of 161 days. The average results of these two years' preliminary work indicated that a cow on good pasture can secure sufficient feed for maintenance and for the daily production of 14 pounds of milk testing 4% butterfat.

In 1926 a test was made by dividing twelve cows into three lots of four cows each. These cows were fed for three periods of eight weeks each as follows: Lot

1 was on good pasture during periods 1 and 3 and in a dry lot during period 2. Lot 2 was in a dry lot during periods 1 and 3 and on good pasture during period 2. Lot 3 was on a good pasture throughout the three periods. When Lots 1 and 2 were in a dry lot the average daily yield of milk was 18.1 pounds containing 0.71 pounds of fat. Their daily ration was 6.71 pounds of grain and 16.33 pounds of hay. When the same cows were on good pasture the average daily yield was 19.4 pounds of milk containing 0.77 pounds of fat. Their daily ration, in addition to pasture, was 3.14 pounds of grain and no hay. For Lot 3, where the cows were on good pasture all three periods, the daily average was 20.5 pounds of milk containing 0.94 pounds of fat. The daily ration, in addition to pasture, was 3.13 pounds of grain and no hay.

Practically all of the land used for this purpose was unsuitable for cultivation, but it was put in condition for mowing, hillside ditches were made to prevent washing, and a variety of grasses and clovers were planted.

Reference: Mississippi Agricultural Experiment Station Information Sheet No. 45, April 1934, "Good Pastures—the Great Need of the South," State College, Mississippi.

Suggestive... What was the gross gain (exclusive of the cost of making and maintaining pasture) due to pasture as reported in the 1934 experiment? In the 1926 experiment?

II

Supplementary Feed Requirements of Ten Cows on Pasture at Clemson College, South Carolina.

Average daily milk production per cow	19.7 pounds
Daily supply of digestible nutrients required per cow	14.5 pounds
Nutrients supplied by barn feeding daily per cow	10.8 pounds
Nutrients obtained from pasture grazing daily	3.7 pounds
Per cent of nutrients obtained from pasture	25.2 percent
Average gain in live weight per cow for season	6.8 pounds

At the beginning of the 1930 grazing season, a test was started to determine the nutrients received by cows from pasture grazing. The pasture was typical of unfertilized permanent pasture sod of the Piedmont section, consisting largely of Bermuda grass with some Dallis grass, lespedeza and, in the lower ground, carpet grass forming the balance of desirable flora.

The pasture was quite heavily stocked, carrying slightly more than one animal per acre of pasture.

Ten cows were used in this test. Careful records of milk and butterfat production, live weight, and supplementary feeds supplied were kept from May 6 to October 13. The supply of supplementary feed was adjusted each 20 days, based on the live weight and production of the animals.

The very limited rainfall during the 1930 growing season was unfavorable to good pasture growth, so the results obtained undoubtedly are below the average which could be expected over a number of years.

Reference: South Carolina Agricultural Experiment Station Forty-fourth Annual Report, Page 58, Clemson College, South Carolina, December 1931.

III

A test was run at Clemson College, South Carolina, in 1932 for the purpose of determining what part of the total digestible nutrients required by 10 dairy cows may be obtained from a Bermuda grass pasture. The pasture was supplemented by a grain mixture fed in such quantities as to prevent an unusual decline in milk production.

Table 32. Summary of Results for Cows on Bermuda Pasture in 1932 at Clemson College, South Carolina.

Herd Number	H-51	H-70 (a)	H-74 (b)	G-37	G-23	Total
Breed	Holstein	Holstein	Holstein	Guernsey	Guernsey	
Age	5-6	3-8	3-10	3-6	5-11	
Days since calving occurred when test began	25	27	59	10	97	.....
Live weight at beginning, pounds	1291	1227	1120	862	878	.....
Gain during trial, pounds	23	28	6	61	91	.....
Cow days on trial	210	161	49	210	210	840
Total milk, pounds	9621.6	7555.0	2060.8	7702.1	6291.3	33230.8
Total fat, pounds	304.8	233.0	67.1	310.1	318.3	1233.3
Fat corrected milk, pounds	8520.5	6517.7	1831.3	7732.7	7291.3	31893.5
Grain fed, pounds	3054.0	2415.0	661.5	2403.0	2446.5	10980.0
Beet pulp fed, pounds	492.0	474.0	123.0	501.0	396.0	1986.0
Total nutrients required for milk maintenance and gain in weight	4767.9	3649.9	1006.4	4054.1	4125.0	17603.3
Total nutrients from barn feeding	2534.0	2099.4	568.2	2105.0	2025.0	9331.6
Total nutrients from pasture	2233.9	1550.5	438.2	1949.1	2100.0	8271.7
% Over maintenance from pasture	4.9	-1.4	2.0	34.3	37.3	16.3 av.

(a) Removed from pasture at 161 days because of acute lameness.

(b) Substituted for H-70.

During the growing season of 1932 a four-acre pasture of practically pure Bermuda sod was grazed at the rate of one cow per acre from April 20 to November 16, a period of 210 days. The only fertilizer treatment given this pasture was an application of 3000 pounds of ground limestone per acre made in May, 1931. This pasture had previously been in cultivation and was planted with Bermuda roots in the spring of 1930, which produced the pure Bermuda sod. Six cages, each 1/1500 of an acre in area were distributed over the four acres in order that clip-pings might be secured at intervals of two weeks for the purpose of measuring yields and making analyses. Each cage was moved to a new location every two weeks.

The cows selected for this test were producing heavily at the start. Pasture was supplemented with a grain mixture fed at such rate as to prevent unreasonable decline in milk flow or excessive decline in body weight.

The nutrients received from pasture, figured in alfalfa hay equivalent, were equal to a yield of 2.04 tons of alfalfa hay per acre.

Footnote Table 1 shows the estimated daily average consumption per cow from pasture for successive months of the grazing season. This estimate is based on analysis of grass from the clipped areas, using the standard co-efficient of digestibility for Bermuda grass.

Footnote Table 1. Estimated Average Daily Consumption From Pasture.

Month of Trial	Green Grass pounds	Dry Matter Pounds	Total Digestible Nutrients pounds
1	73.9	20.62	10.93
2	45.6	16.07	8.93
3	32.8	13.46	7.93
4	53.4	12.75	7.16
5	46.5	16.59	9.62
6	42.0	16.70	9.78
7	38.0	15.29	8.98

Reference: South Carolina Experiment Station Forty-sixth Annual Report, Pages 56, 57, 58 and 59, Tables 15 and 16, Clemson College, South Carolina, December 1933.

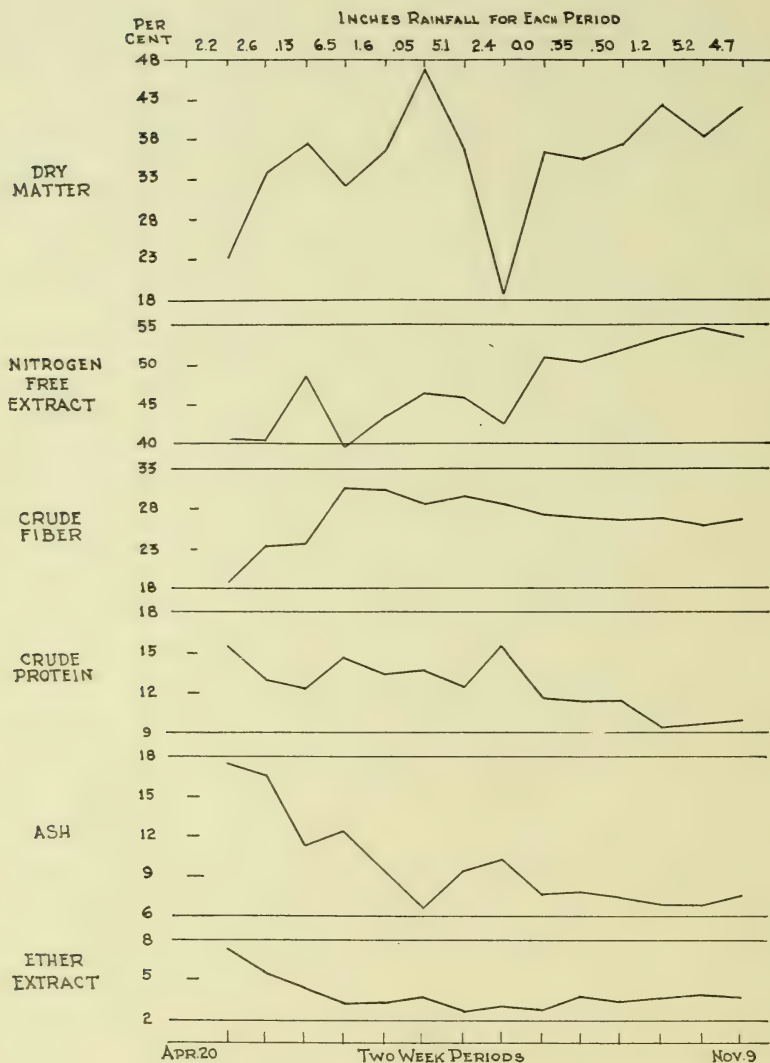
Suggestive: What per cent of the total nutrients required were obtained from pasture?

According to the results reported in table 16 what may have been the result if the total digestible nutrients fed in the form of grain had been fed in the form of good roughage, instead.

IV

SEASONAL VARIATION IN THE COMPOSITION OF PASTURE GRASS

1932



NOTE: DRY MATTER IS EXPRESSED AS A PERCENTAGE OF GREEN WEIGHT, AND OTHER CONSTITUENTS ARE EXPRESSED AS A PERCENTAGE OF DRY MATTER

Graphs by courtesy South Carolina Agricultural Experiment Station, Clemson College, South Carolina.

Showing the seasonal variation in the composition of the pasture grass as reported in Table 32. What effect did rainfall variation have on each of the components?

A study of the effect of fertilizer on permanent pasture was begun in 1929 by the South Carolina Agricultural Experiment Station in cooperation with the Chemistry Department. Forty-six plots were originally included in this study and 16 supplementary plots were added in 1930. The fertilizer was applied at the rate of 600 pounds per acre. The results from seventeen plots indicate the trend on all plots included in the experiment.

Table 33. The Effect of Fertilizer On Limed And Unlimed Pasture at Clemson College, South Carolina, 1929-32

Treatment (600 lbs. per acre) N-P-K	Green Yield of Permanent Pasture Grasses									
	Limed Plots					Unlimed Plots				
	1929	1930	1931	1932* Average	First 3 Year Average	1929	1930	1931	1932* Average	First 3 Year Average
NITROGEN SERIES										
0-12-6	7808	4380	7670	7820	6919.5	6619.33	7860	3520	5920	5217.5
4-12-6	.....	.....	.....	.....	8348.5	7611.33	9680	4420	5190	5680
6-12-6	9536	5300	8980	12030	8961.5	7938.66	9441	4865	5420	6091.5
8-12-6	10880	6366	8450	10240	8980.0	8565.33	10700	5920	6880	7580
9-12-6 (a)	10020	5920	9120	10380	8860.0	8353.33	12280	5800	7760	7770.0
PHOSPHORUS SERIES										
6-0-6	9082	5340	6170	5880	6618.0	6861.00	10590	5380	4810	4100
6-8-6	9632	5940	8030	8770	8093.0	7867.33	11672	4900	6200	6120
6-12-6	9536	5300	8980	12030	8961.5	7938.66	9641	4865	5420	6141.5
6-16-6	9740	6180	8360	11900	9045.0	8093.33	11880	5320	7180	6020
POTASH SERIES										
6-12-0	8340	4930	7380	6520	6792.5	6883.33	11492	4780	5460	5680
6-12-4	10514	5830	9490	10460	9173.5	8744.66	10300	5320	6420	8730
6-12-6	9536	5300	8980	12030	8961.5	7938.66	9641	4865	5420	7693.0
6-12-8	8994	5960	8950	10100	8501.0	7968.00	10850	5280	6490	6141.5
MISCELLANEOUS										
0-0-0	8122	3148	3080	5140	4872.5	4783.33	6320	2724	1680	3860
6-0-0	10140	5680	4600	4820	6310.0	6806.66	9460	3958	3810	4620
0-12-0	7948	3956	5890	8340	6533.5	5931.33	8460	3178	2890	6080
0-0-6	8680	3944	4500	7080	6051.0	5708.00	7420	3068	2090	4570

(a) Nitrogen applied in three applications, April, June and August.

* No nitrogen applied in 1932.

Chemical analyses were made of the grass on the various plots during the first three years. It will be of interest to note the highest and lowest analysis on all plots both limed and unlimed, during the 3 years.

Footnote Table 1—Highest and Lowest Analysis of Pasture Grasses Reported in Table 33.

[illegible]

The limed series of plots received ground limestone at the rate of two tons per acre in the spring of 1929. No limestone has been applied since that date.

Fertilizer of the composition indicated on the tabulation was applied at the rate of 600 pounds per acre at the beginning of the 1929, 1930, and 1931 seasons. No fertilizer was applied in 1932.

Phosphorus was supplied as superphosphate, nitrogen was supplied as sodium nitrate, and potash was supplied as muriate of potash.

All plots were clipped at two-week intervals throughout the growing season.

The total rainfall for the growing season for each of the four years was as follows:

1929	40.16 inches
1930	18.33 inches
1931	19.98 inches
1932	24.99 inches

The lime applications were made in March of 1929 as a surface treatment; consequently, the effects of lime are not apparent in the 1929 yields.

Both the 1930 and 1931 seasons were unusually dry, which undoubtedly caused the effect of different fertilizer treatments to be lower than would normally be expected.

Both yields and the increased percentage of clovers were very marked on the limed series of plots in 1932.

Reference: South Carolina Agricultural Experimental Station Forty-fifth and Forty-sixth Annual Reports, Page 58, Forty-fifth Annual Report, Pages 55 and 56, Table 14, Forty-sixth Annual Report, Clemson College, South Carolina

Suggestive: How much hay was saved by each 100 pounds of green grass eaten? (Footnote table 1 under table 32 gives some indication of the dry weight of 100 pounds green Bermuda grass)?

How much grass was produced on each of the two plots where no fertilizer was applied?

How much where nitrogen was added?

Where phosphorus was added?

Potash?

Was the use of fertilizer profitable, considering the present prices of fertilizer and hay?

What influence did rainfall during the growing season have on the profitableness of fertilizer?

How much of each fertilizer element may profitably be used per acre?

What is the relation between rainfall and the composition of pasture grasses?

What is the relation between the production of grass per acre and the analysis?

VI

Pasture Plus Grain vs. Pasture Alone at State College, New Mexico.

In the summers of 1909, 1911, and 1914 experiments were run to determine whether it pays to feed grain to cows in good pasture, in this State. The cows in the experiment were on pasture day and night and always kept together and handled alike, except that one lot received grain at milking time, half of the grain ration in the morning and half at evening. Three pastures were used and the cattle moved about to permit irrigation and to keep the pastures in good condition. The pastures used consisted of the following:

No. 1, 15 acres of mixed grasses, spring wheat and oats, native grasses and some alfalfa.

No. 2, 30 acres of poor mixed pasture, same as No. 1, but with more weeds.

No. 3, 9 acres with a good stand of Johnson grass. This grass made the best pasture, but an attempt has since been made to free this field from Johnson grass, at great pains and expense, by clean cultivation. Difficulty of eradication makes this grass unsuitable for pasture, in many cases, in the irrigated valleys of New Mexico.

Experiment 1

May 31 to October 3, 1909

Table 34. Pasture Plus Grain vs. Pasture Alone At State College, New Mexico.

	Lot I	Lot II	Increase of	Per cent
	Pasture Alone	Pasture plus 6 lbs. grain per cow per day	Grain-Fed Lot	In- crease
Milk produced	10,897 lbs.	11,605 lbs.	708 lbs.	6.5
Butter-fat produced	487.1 lbs.	531.2 lbs.	44.1 lbs.	9
Grain eaten		3,780 lbs.	.....	.....
Feed Cost .....	....			
Feed cost per hundredweight of milk				
Feed cost per pound of butter-fat				
Average total loss in weight per cow, during 4 months	11 lbs.	28 lbs.		

The available cows were divided into two groups of five each. Lot 1 received no grain throughout the eighteen weeks of the experiment. Lot II received 6 pounds of grain per head daily throughout the experiment. The grain consisted of a mixture of two parts bran and one part cottonseed meal. The cows in the two lots were very closely balanced in length of time they had been milking and in milk and butter-fat production at the start of the experiment, the average daily production for the preceding four weeks being 21.7 pounds of milk and .813 pounds of butter-fat for Lot I, and 21.0 pounds of milk and .814 pounds of butter-fat for Lot II.

Experiment 2
May 20 to October 1, 1911

Table 35. Comparison of Results of Lots With and Without Grain at State College, New Mexico.

(16 cow-months)	Lots Fed Grain	Lots Fed No Grain	Increase Due to Grain: %
Milk produced	9,955 lbs.	9,345 lbs.	6.5
Fat produced	417.9 lbs.	384.6 lbs.	8.6
Grain eaten	2,400 lbs.	none	.....
Cost of feed .....	.....	.....	.....
Feed cost per cwt. milk .....	.....	.....	.....
Feed cost per lb. butterfat .....	.....	.....	.....
Av. gain in weight per cow per month	13 lbs.	10 lbs.	.....

In this experiment the lots were alternated monthly between the grain and no grain rations and the grain mixture was made more varied and thought to have been improved. There were four periods of thirty days each with five-day intervals to change the rations. The lots consisted of an uneven number of cows from month to month, due to many of the cows freshening in the late summer or fall, but the two lots were kept balanced in number and quite fairly balanced with regard to production.

The grain ration consisted of three parts corn meal, two parts cottonseed meal, and one part bran. Six pounds were fed daily to each cow receiving grain, 3 pounds in the morning and 3 pounds at evening, except in cases of cows being off feed.

Experiment 3
June 1 to July 31, 1914

This experiment was run on the same plan as Experiment 2, there being two lots of four cows each, the same cows remaining in the lots throughout the experiment. The allowance of grain was smaller than in previous experiments and fed in a definite proportion to the amount of milk given, one pound of grain for each five pounds of milk.

The grain mixture consisted of ground corn five parts, bran two, and cottonseed meal one part from June 1 to June 25; bran six, and cottonseed meal one part from June 26 to July 14; and bran four parts, shorts two, and cottonseed meal one part from July 15 to 31.

Lot one received grain during June in addition to pasture, and Lot II received no grain. During July the rations were reversed, and Lot II received grain.

Table 36. Results of Experiment 3

Lots Fed Grain	Milk Produced	Butter-fat Produced	Grain Fed	Cost of Feed	Feed Cost per cwt. of Milk	Feed Cost per lb of Butter-fat
	Lbs.	Lbs.	Lbs.	Dollars	Cents	Cents
Period 1, Lot I	3015	114.2	512	.....	.....	.....
Period 2, Lot II	2785	133.7	496	.....	.....	.....
Both periods	5800	247.9	1008	.....	.....	.....
Lots on Pasture Alone						
Period 1, Lot II	2721	125.3	.....	.....	.....	.....
Period 2, Lot I	3013	117.0	.....	.....	.....	.....
Both periods	5734	242.3	.....	.....	.....	.....
Increase due to grain	66	5.6	.....	.....	.....	.....

Although not definitely a part of the experiment, this trial was continued through August. Both lots produced less milk in August than in July, but Lot I changing from grain to no grain, fell off considerably more than did Lot II changing from pasture alone to grain ration. Comparing the two lots for July

and August it will be found that the grain fed lots produced 174 pounds more milk, or an increase of 3¼ %.

Reference: New Mexico Agricultural Experiment Station Bulletin No. 98, pages 11, 12, 13, 14, 15 and 16, Tables 1, 2, 3, 4, and 5, June, 1915. "Economic Feeding for Milk Production in New Mexico." Las Cruces, New Mexico.

Suggestive: In each of the experiments what was the difference in milk produced on pasture alone and pasture with grain? How much grain was consumed in each case? According to Form 5, which is more economical in each case?

WHAT ARE THE ANNUAL NUTRIENT REQUIREMENTS OF DAIRY COWS?

Table 37. Nutrient Requirements Per Day Per 1,000 Pounds of Body Weight

	Haecker Standard		Savage Standard	
	Digestible Crude Protein	Total Digestible Nutrients	Digestible Crude Protein	Total Digestible Nutrients
For Maintenance of 1,000 pounds cow	0.700	7.925	0.700	7.925
For Production of Milk				
For production of each pound milk testing:				
2.5 %	0.045	0.254	0.053	0.257
3.0 %	0.047	0.284	0.057	0.287
3.5 %	0.049	0.315	0.061	0.319
4.0 %	0.054	0.343	0.065	0.350
4.5 %	0.057	0.372	0.069	0.379
5.0 %	0.060	0.398	0.073	0.405
5.5 %	0.064	0.424	0.077	0.431
6.0 %	0.067	0.451	0.081	0.457
6.5 %	0.072	0.480	0.085	0.484
7.0 %	0.074	0.502	0.089	0.508

Reference: "Feeds and Feeding," Henry and Morrison, page 133.

The annual nutrient requirements for each cow may be determined by (1) multiplying weight of cow x daily requirement x 365 and (2) adding to this the
1000
annual production of milk x nutrients required per pound of milk of the same butterfat test as that produced.

WHAT PERCENTAGE OF THE TOTAL NUTRIENTS REQUIREMENTS OF DAIRY COWS MUST BE FED TO THEM?

During what months will your cows keep their flesh and give a gallon or more of milk per day per cow?

During what other months will they simply maintain their flesh?

During what months will they lose flesh if dry?

What percentage of the original body weight will be maintained during these months?

Then what are the net requirements?

Pounds crude digestible protein to be fed _____

Pounds total digestible nutrients to be fed _____

This should be worked out for each cow and totaled to get the nutrients required for all dairy cows on the farm.

How should these requirements be satisfied?

Form 6. A Suggestive Method of Evaluating Various Rations from any Source to Determine the Best Feeding Program for Furnishing the Net Requirements of the Dairy Cows of a Given Farm.

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FEEDING EXPERIMENTS

WITH

FARM WORK MULES

Delta Experiment Station

Stoneville, Mississippi

By

Roy Kuykendall

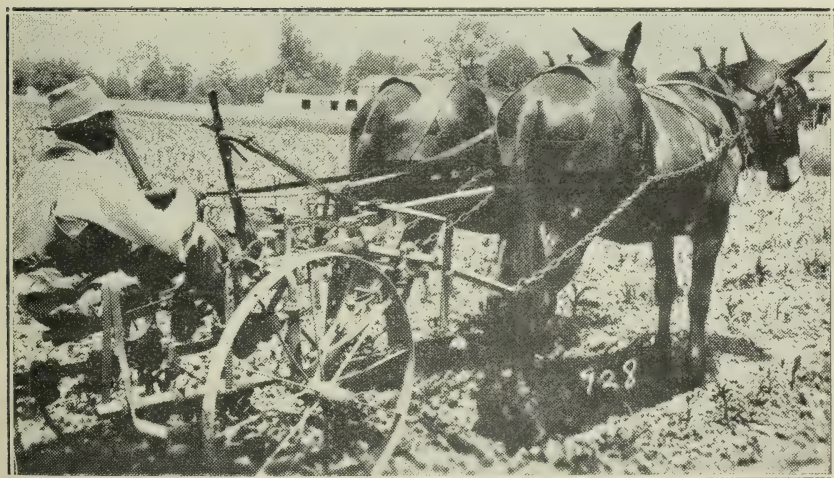


Figure 1. Left, Tom in self-feeder lot. - Right, Jerry in hand-fed lot.

MISSISSIPPI AGRICULTURAL EXPERIMENT STATIONS

State College, Mississippi

J. R. RICKS, Director

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Feeding Experiments with Farm Work Mules

By

Roy Kuykendall*

INTRODUCTION

Feed for, and feeding Delta farm mules are two very important problems of the Delta Planter.

This bulletin covers the data on Delta Station mule feeding work over a period of eight years. This work has consisted of several different types of feeding experiments. The practical and economical side of feeding, as well as balanced rations, have been considered in planning these investigations.

METHODS AND FEEDS

The mules used in these experiments represented the average mules on a well balanced plantation. They were worked in pairs, one from each comparative lot, most of the time. The lots compared were averaged in weight, quality, speed, physical condition, etc., as nearly as possible. All lots were fed twice a day, and all mules in each lot were fed together in one manger. The total daily feed for each lot was weighed daily except in self feeding. The roughage in all tests consisted of alfalfa hay or slightly mixed alfalfa except where otherwise stated. The grain usually consisted of shelled corn, but oats were substituted for corn for a few short periods. When feeding cottonseed cake or meal in the self feeder, 25-lbs of oyster shell flour per 1000-lbs of cake or meal and sufficient salt was mixed in the feeder. Except in one or two of the first tests, the mules were weighed individually on three consecutive mornings at the beginning and at the end of the tests and the three weights averaged for initial and final weights, respectively. They were weighed individually every Monday morning during the tests. The work consisted of general plantation labor. The daily consumption of feed per 1000-lbs. live weight was calculated by using the average mule weight over the entire test period.

Mule feeding work at this Station was begun in 1927 and has consisted of the following experiments:

1. Thrashed sagrain compared with shelled corn.
2. Chopped and unchopped sagrain stover compared.
3. Chopped and unchopped soybean hay compared.
4. Green sagrain heads and stalks compared with corn and hay.
5. Self feeding grain compared with hand feeding.
6. Heavy and very heavy cottonseed meal feeding.
7. Corn alone compared with corn and cottonseed cake as concentrates.
8. Corn alone compared with corn, cottonseed cake, and blackstrap molasses.
9. Cottonseed hulls compared with alfalfa hay.

* Acknowledgements: The Author wishes to express his appreciation to Mr. W. E. Ayres, Assistant Director in charge of the Delta Station, for his constructive criticisms and helpful suggestions while these investigations were in progress; to Mr. W. C. McGee who kept the work records, for his cooperation; to Mr. J. B. Turner who conducted the 1927 tests; and to Director J. R. Ricks and members of his Central Station staff for their suggestions.

EXPERIMENTAL RESULTS

CORN AND THRASHED SAGRAIN

The purpose of this test was to determine the comparative value of thrashed sagrain and shelled corn. Each lot consisted of one mule from each of nine pairs. The two lots were fed alike except Lot 2 received thrashed sagrain rather than shelled corn. The results are presented in Table I.

TABLE I.—Thrashed Sagrain Compared with Shelled Corn

March 1—April 21, 1927

Lot No.	Grain Fed	Av. Lbs. Consumed Daily per 1000 Lbs. Live Wt.				Av. Weight per Mule in Lbs.			Av. Gain per Mule in Lbs.	Av. No. Days Worked per Mule
		Shelled Corn	Thrashed Sagrain	C. S. Meal	Roughage	Begin Test	During Test	End Test		
1	Corn -----	12.05	.	.9	9.81	1230	1230	1231	1	20.8
2	Sagrain -----		12.05	.9	9.81	1221	1230	1220	—1	19.3

It has been generally accepted that grain sorghum has about 90% of the feeding value of corn, but the results in Table I. indicate that thrashed sagrain is equal, pound for pound, to shelled corn as mule feed; but due to its being so limited, the work should be repeated to be conclusive.

SAGRAIN STOVER

In 1928 work was begun comparing sagrain stover (cured and bundled sagrain from which the heads were removed) chopped with a feed mill, about as silage is chopped, and unchopped stover as roughage for mules. The purpose of chopping the stover was to increase palatability and decrease waste. An effort was made to feed the lots equal amounts of concentrates per unit weight and to so feed stover to the two lots as to maintain them in similar condition.

There were four feeding periods in this test. The first began May 19 and continued through July 15, 1928; the next extended from March 4 to June 30, 1929; the third began December 2, 1929 and continued through April 2, 1930; and the final period began January 19, 1931 and ended July 28, 1931. The lots consisted of one mule from each of eight teams in the first period, one mule from each of seven teams in the second period, one mule from each of eight teams in the third period, and one mule from each of seven teams in the final period. In the first period Lot 2 was fed the chopped stover; in the second, Lot 1; in the third, Lot 2 was fed the chopped stover again; and in the final period the lots were reversed again.

Results of these four periods with the average are presented in Table II.

TABLE II.—Chopped and Unchopped Sagrain Stover Compared
1928-1931

Lot No.	Condition of Roughage	Av. Lbs. Consum- ed Daily per 1000 Lbs. Live Wt.			Av. Weight per Mule in Lbs.			Av. Gain per Mule in Lbs.	Av. No. Days Worked per Mule
		Other Grains	C. S. Meal	Rough- age	Begin Test	During Test	End Test		
May 19—July 15, 1928									
2	Chopped -----	12.31	.91	8.8	1217	1218	1238	21	31.7
1	Unchopped -----	12.06	.89	8.9	1242	1244	1242	0	32.4
March 4—June 30, 1929									
1	Chopped -----	12.77	.86	6.8	1265	1251	1273	8	No
2	Unchopped -----	13.06	.87	9.4	1260	1237	1258	—2	records
December 2, 1929—April 2, 1930									
2	Chopped -----	8.81	.79	8.0	1265	1265	1238	—27	57.4
1	Unchopped -----	8.43	.76	9.0	1317	1323	1309	—8	56.4
January 19—July 28, 1931									
1	Chopped -----	9.89	1.16	9.9	1323	1288	1275	—58	52.3*
2	Unchopped -----	10.06	1.18	12.3	1321	1266	1241	—80	54.2*
Average 4 periods									
	Chopped -----	10.58	.96	8.5	1268	1265	1256	—12	47.1
	Unchopped -----	10.58	.96	10.3	1285	1270	1263	—22	47.7

*Work days recorded April 27—July 18 only.

The average work mule days cover only three periods, because the work records for the period of March 4—June 30, 1929 were lost.

The average results in Table II. indicate that about 18% of the unchopped roughage was wasted. No attempt was made to calculate the cost of chopping. If the value of the 18% roughage saved by chopping is more than sufficient to pay the cost of chopping, it is economical to chop cured sagrain stover as roughage for mules.

SOYBEAN HAY

After concluding the work on chopped and unchopped sagrain stover, similar work was begun with soybean hay. Each lot consisted of one mule from each of seven pairs. Both lots were fed the same except Lot 2 was fed chopped hay. The results of this test are shown in Table III.

TABLE III.—Chopped and Unchopped Soybean Hay Compared
April 3—September 3, 1930

Lot No.	Condition of Roughage	Av. Lbs. Consumed Daily per 1000 Lbs. Live Wt.			Av. Weight per Mule in Lbs.			Av. Gain per Mule in Lbs.	Av. No. Days Worked per Mule
		Other Grain	C. S. Meal	Roughage	Begin Test	During Test	End Test		
1	Chopped -----	10.10	1.17	8.98	1265	1272	1280	15	88.1
2	Unchopped -----	10.04	1.16	9.41	1288	1280	1286	—2	83.0

Only about 4.5% of unchopped soybean hay was wasted when fed to mules. This was insufficient to pay the cost of chopping. Chopping coarse soybean hay may be justified when roughage is extremely scarce and high priced and the work very hard.

GREEN SAGRAIN

From August 15 through November 14, 1929, a test was carried on to determine the value of green sagrain alone for work mules compared to shelled corn and hay with small amounts of cottonseed meal fed to both lots. The sagrain was cut and bundled with a corn binder and fed green. Each lot consisted of one mule from each of six teams. From August 15—November 14, 1932, this test was duplicated, feeding Lot 1 sagrain and larger amounts of cottonseed meal, and Lot 2 corn and hay omitting the meal. Each lot consisted of one mule from each of five teams. The results of this test are shown in Table IV.

TABLE IV.—Green Sagrain Heads and Stalks Compared with
Corn and Hay

Lot No.	Kinds of Feed Used	Av. Lbs. Consum- ed Daily per 1000 Lbs. Live Wt.			Av. Weight per Mule in Lbs.			Av. Gain per Mule in Lbs.	Av. No. Days Worked per Mule
		Shelled Corn	C. S. Meal	Rough- age	Begin Test	During Test	End Test		
August 15—November 14, 1929									
1	Corn & hay -----	12.18	.99	11.19	1309	1343	1305	—4	39.6
2	Sagrain -----		1.02	2.7*	1320	1298	1239	—81	44.5
August 15—November 14, 1932									
1	Sagrain -----		2.85	2.79*	1431	1377	1363	—68	52.5
2	Corn & hay -----	10.52		10.52	1428	1426	1430	2	55.4

*Bundles and not pounds of green sagrain. The bundles averaged approximately 20 pounds each when green and 8 pounds each when dried.

These results indicate that green sagrain heads and stalks should be supplemented with more than three pounds of cottonseed meal, or its equivalent of some other grain, to maintain the weight of work mules. These mules only

EXPERIMENTAL MULE FEEDING

7

consumed an average of 2.7 bundles of sragrain and 1.02-lbs. cottonseed meal daily per 1000-lbs. live weight in the first period, and 2.79 bundles sragrain and 2.85-lbs. cottonseed meal in the last period, which did not contain sufficient grain for mules doing farm work.

HAND AND SELF FEEDING

In 1930 hand and self feeding concentrates were compared. A self feeder was built according to Figure 2, and used for this test. The self-fed mules had free access to a mixture of grain and cottonseed meal, whereas the hand-fed ones were limited. The cottonseed meal and grain was given in the same proportion to both lots.

This work consisted of three periods. The first began April 4 and ended October 22, 1930. Each lot was composed of one mule from each of seven teams. The second period began March 4 and ended August 30, 1931; and the mules changed lots from the first period. Six mules, one from each of six pairs, were used in each lot. In the third period, April 4 to August 3, 1932, one mule from each of the seven teams was used for each lot. The mules consisted of a few of the mules used previously and some new ones in this last period. An attempt was made to feed the same amount of roughage (which consisted mostly of alfalfa hay) per unit weight. The cottonseed meal was poured in with the corn to the handfed lot. The self-fed mules never had colic nor any other digestive trouble from over eating. Results of these three periods with the average are shown in Table V.

**TABLE V.—Hand Feeding and Self Feeding Compared
1930-1932**

Lot No.	Feeding Method	Av. Lbs. Consumed Daily per 1000 Lbs. Live Wt.			Av. Weight per Mule in Lbs.			Av. Gain per Mule in Lbs.	Av. No. Days Worked per Mule
		Other Grain	C. S. Meal	Roughage	Begin Test	During Test	End Test		
April 4—October 22, 1930									
3	Hand fed -----	9.43	.76	10.18	1331	1363	1358	27	121.3
4	Self fed -----	10.95	.89	10.15	1358	1407	1438	80	113.7
March 4—August 30, 1931									
4	Hand fed -----	9.90	.67	10.80	1394	1388	1408	14	94.7
3	Self fed -----	11.44	.70	9.53	1436	1465	1451	15	91.2
April 4—August 3, 1932									
3	Hand fed -----	10.25	.68	9.89	1459	1463	1472	13	64.5
4	Self fed -----	11.77	.79	8.60	1422	1453	1418	—4	61.7
Average 3 periods									
3	Hand fed -----	9.80	.71	10.44	1395	1395	1406	11	93.7
4	Self fed -----	11.34	.80	9.54	1404	1438	1435	31	88.9

These tests indicate that mules are good judges of the amount of feed required for the work being performed. For MAXIMUM EFFICIENCY work mules must be in good condition. Self feeding will keep them so at an additional daily cost of only a few cents.

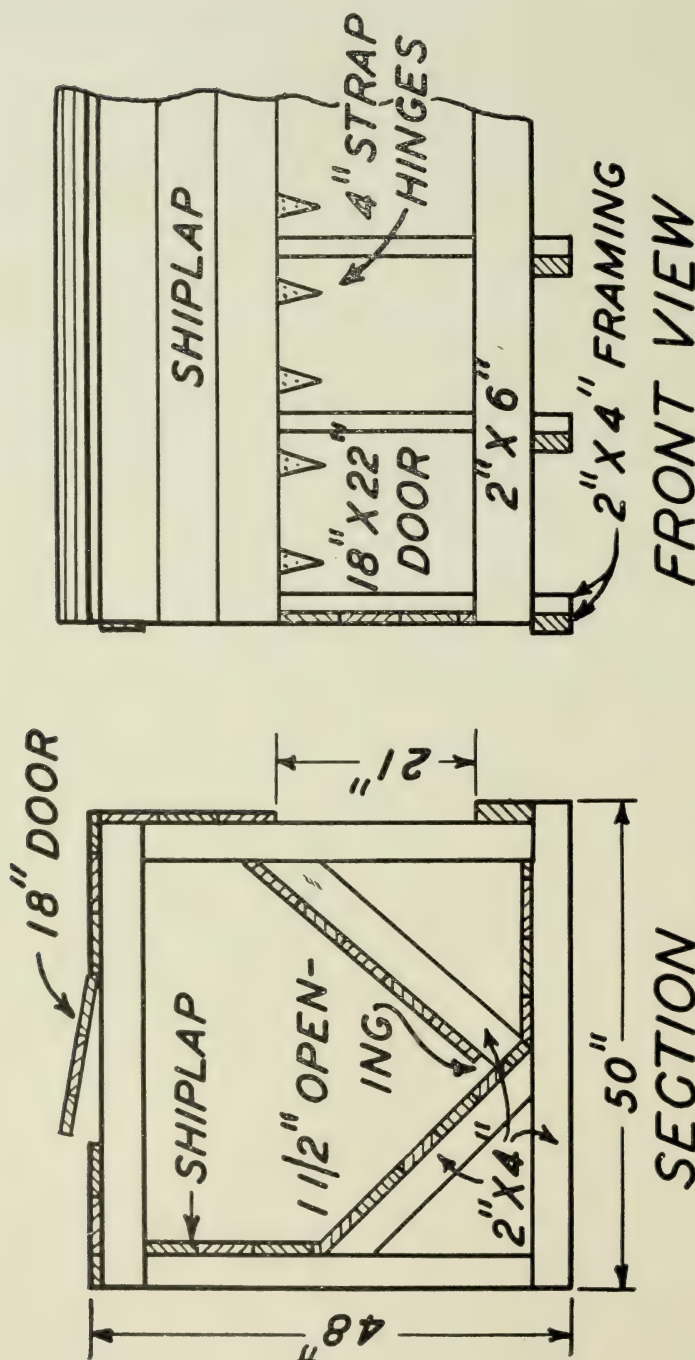


Figure 2. Since cottonseed cake is the Delta's cheapest mule feed, keeping it before the mules is a very economical practice. This is most easily and satisfactorily done with self-feeders. They insure a constant supply of clean cake and minimize waste. Details of a satisfactory self-feeder are given above. The feeder should be as long in feet as there are mules to be fed. One door for 3 mules is sufficient. The capacity is most easily increased by increasing the height. The framing for the front slope must be cut to fit between the floor of the back slope and the front studs to permit the doors to work. The doors are 1 inch longer than the opening so they swing against the 2x6 across the front. The hinges are right-side out on the door and wrong-side out on the front of the feeder, to which the doors are hung.



Figure 3. Left, Jerry in hand-fed lot. Right, Tom in self-feeder lot.

COTTONSEED MEAL

Cottonseed meal is the second major crop in the Yazoo-Mississippi Delta and is only out-ranked in value in Mississippi by corn and lint cotton. Until recently, majority opinion indicated that 1 to 1.5-lbs. of cottonseed meal daily was as much as a mule could safely consume.

In 1932, after feeding a limited amount of cottonseed meal to work mules for several years, the Delta Station undertook to determine how much cottonseed meal mules would safely and satisfactorily consume if other grain was limited. The plan was to feed three and four pounds of cottonseed meal daily per 1000 pounds live weight to Lots 2 and 1 respectively. These lots consisted of one mule from each of six teams. Previous data indicated that mules doing average farm work required about 12.3 pounds of concentrates per 1000-lbs live weight. This same data indicated cottonseed meal was worth twice as much as an equal weight of corn. It was planned, therefore, to feed daily six and four pounds of corn per 1000-lbs. live weight to Lots 2 and 1 respectively, in addition to three and four pounds of cottonseed meal. The plan was to feed each lot 11.5-lbs of hay daily per 1000-lbs. live weight. The amount of corn had to be reduced before the mules would eat the planned amounts of cottonseed meal.

TABLE VI.—Heavy and Very Heavy Feeding of Cottonseed Meal

April 2—August 1, 1932

Lot No.	C. S. Meal Rates	Av. Lbs. Consumed Daily per 1000 Lbs. Live Wt.			Av. Weight per Mule in Lbs.			Av. Gain per Mule in Lbs.	Av. No. Days Worked per Mule
		Other Grain	C. S. Meal	Rough age	Begin Test	During Test	End Test		
1	Very Heavy -----	3.09	3.59	11.98	1285	1252	1213	—72	58.6
2	Heavy -----	5.36	2.58	11.57	1317	1297	1268	—49	57.8

There was no digestive or other physical trouble in either lot caused by feeding excessive amounts of cottonseed meal. The results indicate that both lots in Table VI. failed to maintain their weights, but they did consume excessive amounts of cottonseed meal with no visible physical troubles.



Figure 4. Lot One consumed an average of 3.59 pounds of cottonseed meal and 3.09 pounds of shelled corn daily per 1000 pounds of live weight during the period of April 2-August 1, 1932.

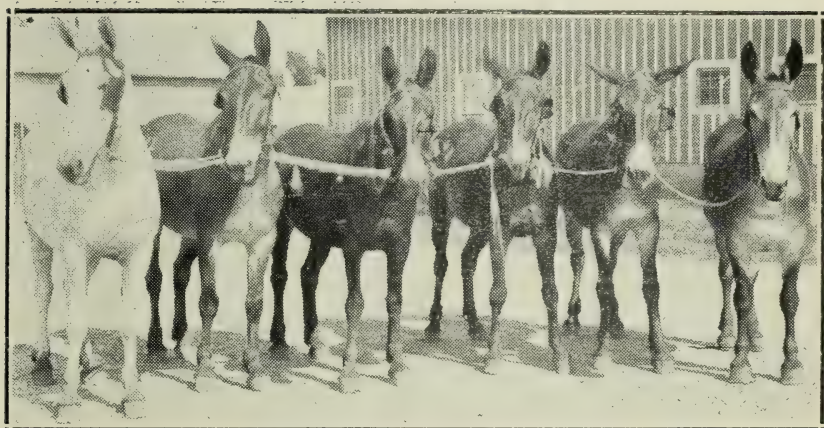


Figure 5. Lot Two consumed an average of 2.58 pounds of cottonseed meal and 5.36 pounds of shelled corn daily per 1000 pounds of live weight during the period of April 2-August 1, 1932.

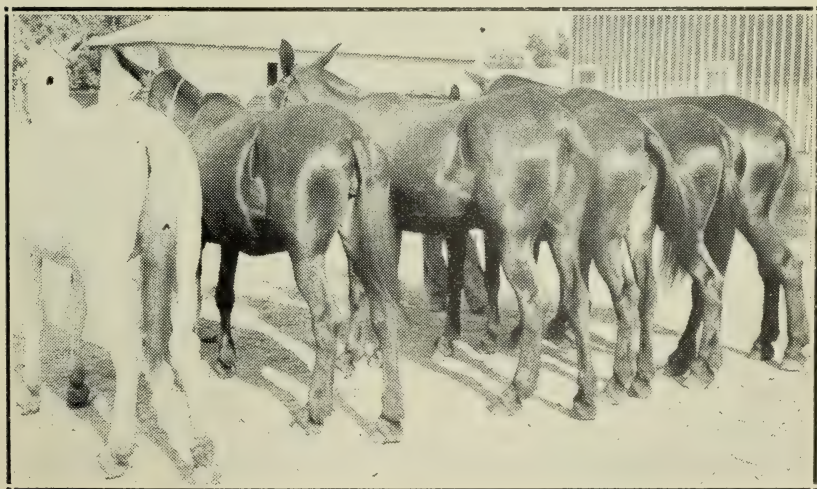
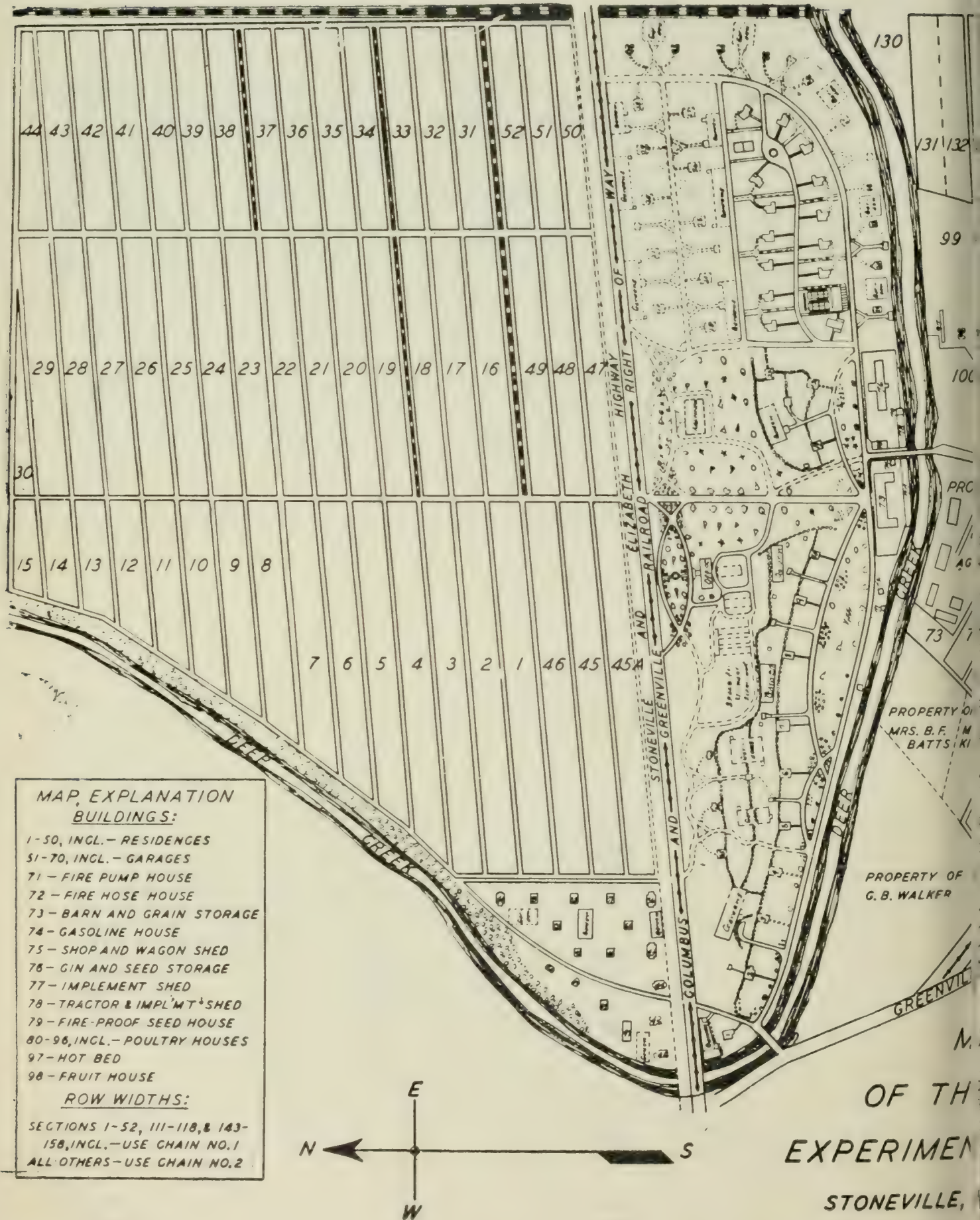
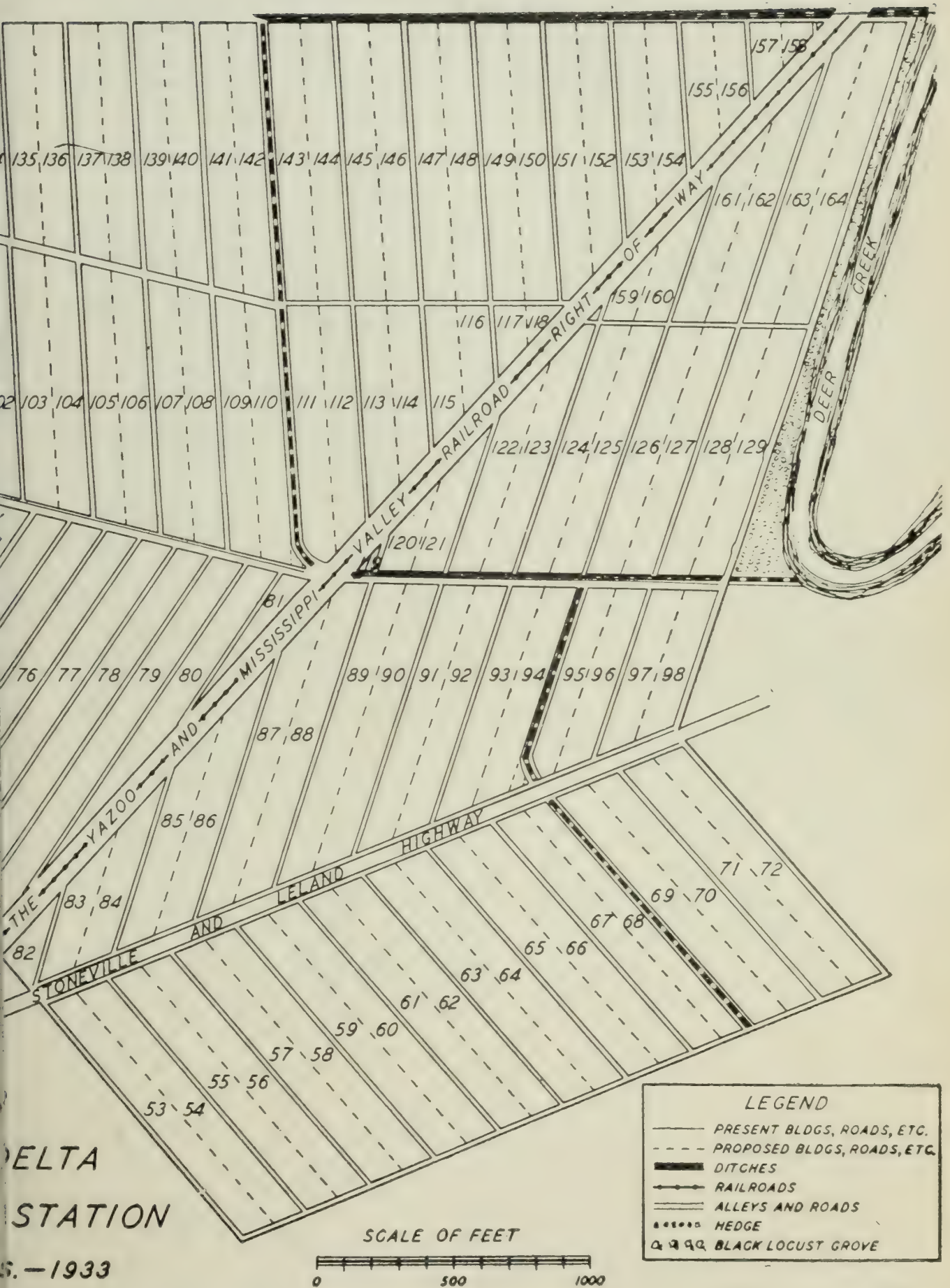


Figure 6. Lot One consumed an average of 3.59 pounds of cottonseed meal and 3.09 pounds of shelled corn daily per 1000 pounds of live weight during the period of April 2-August 1, 1932.





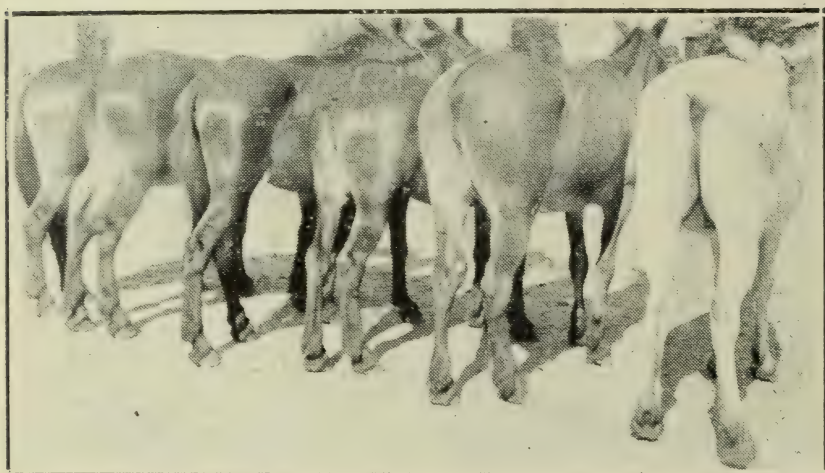


Figure 7. Lot Two consumed an average of 2.58 pounds of cottonseed meal and 5.36 pounds of shelled corn daily per 1000 pounds of live weight during the period of April 2-August 1, 1932.

COTTONSEED CAKE

In 1933 the studies with cottonseed products were continued, but cracked cake was used instead of meal. Lots 1 and 2 each consisted of one mule from each of six pairs. The plan was to feed six pounds of corn per 1000-lbs. live weight daily to Lot 2 and give the mules access to cottonseed cake in a self feeder. Lot 1 was to be given 11.5-lbs. of corn per 1000-lbs. live weight to be compared with Lot 2. An attempt was made to feed both lots approximately 11-lbs. of hay per 1000-lbs. live weight. The mules in Lot 3 and 4 were fed the same as 1 and 2 respectively except Lot 4 was fed 4-lbs. of corn per 1000-lbs. live weight instead of six pounds. Results of these tests are shown in Table VII.

TABLE VII.—Corn Alone Compared with Corn and Heavy and Very Heavy Rations of Cottonseed Cake—March 13—July 13, 1933.

Lot No.	Concentration Fed	Av. Lbs. Consumed Daily per 1000 Lbs. Live Wt.			Av. Weight per Mule in Pounds			Av. Gain per Mule in Lbs.	Av. No. Days Worked per Mule
		Shelled Corn	C. S. Cake	Roughage	Begin Test	During Test	End Test		
1	Corn -----	11.58		11.34	1327	1323	1307	—20	83.2
2	Corn & Cake -----	6.25	2.33	11.72	1319	1280	1250	—69	76.6
3	Corn -----	11.40		11.40	1442	1461	1449	7	79.0
4	Corn & Cake -----	4.16	3.47	11.98	1434	1391	1352	—82	80.7

According to Table VII, farm work mules will not consume a sufficient amount of cottonseed cake to maintain their weight when limited to six pounds or less of shelled corn per 1000-lbs. live weight.

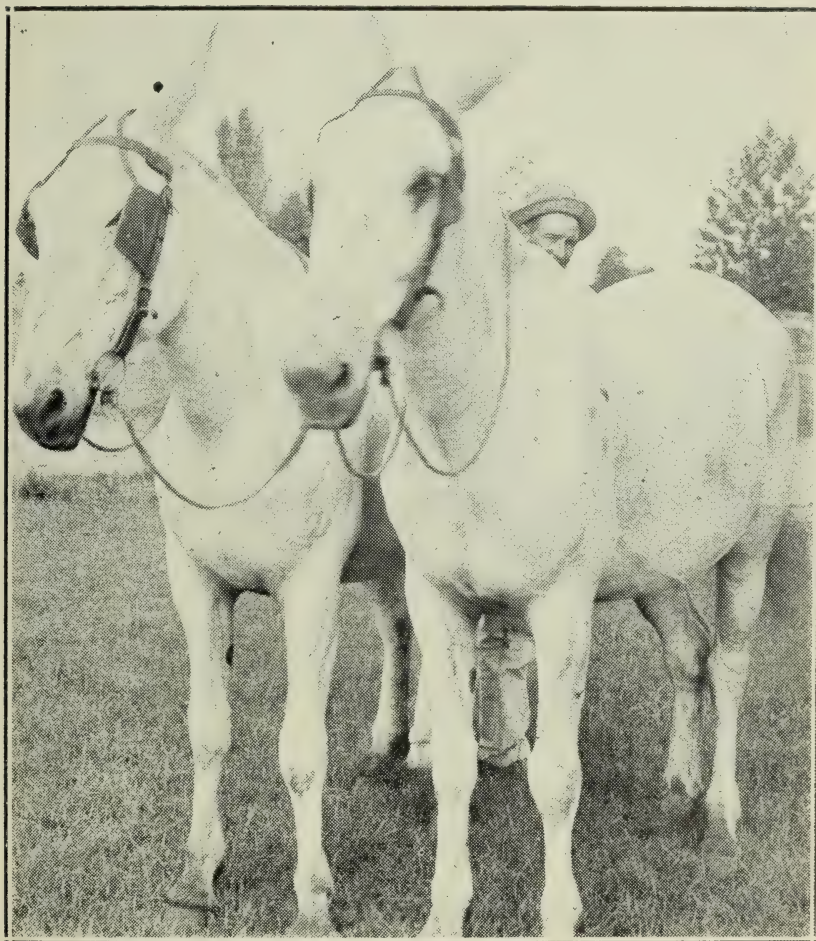


Figure 8. Left, Ike consumed an average of 2.58 pounds of cottonseed meal and 5.36 pounds of shelled corn daily per 1000 pounds of live weight during the period of April 2-August 1, 1932.

Right, Mike consumed an average of 3.59 pounds of cottonseed meal and 3.09 pounds of shelled corn daily per 1000 pounds of live weight during the same period.

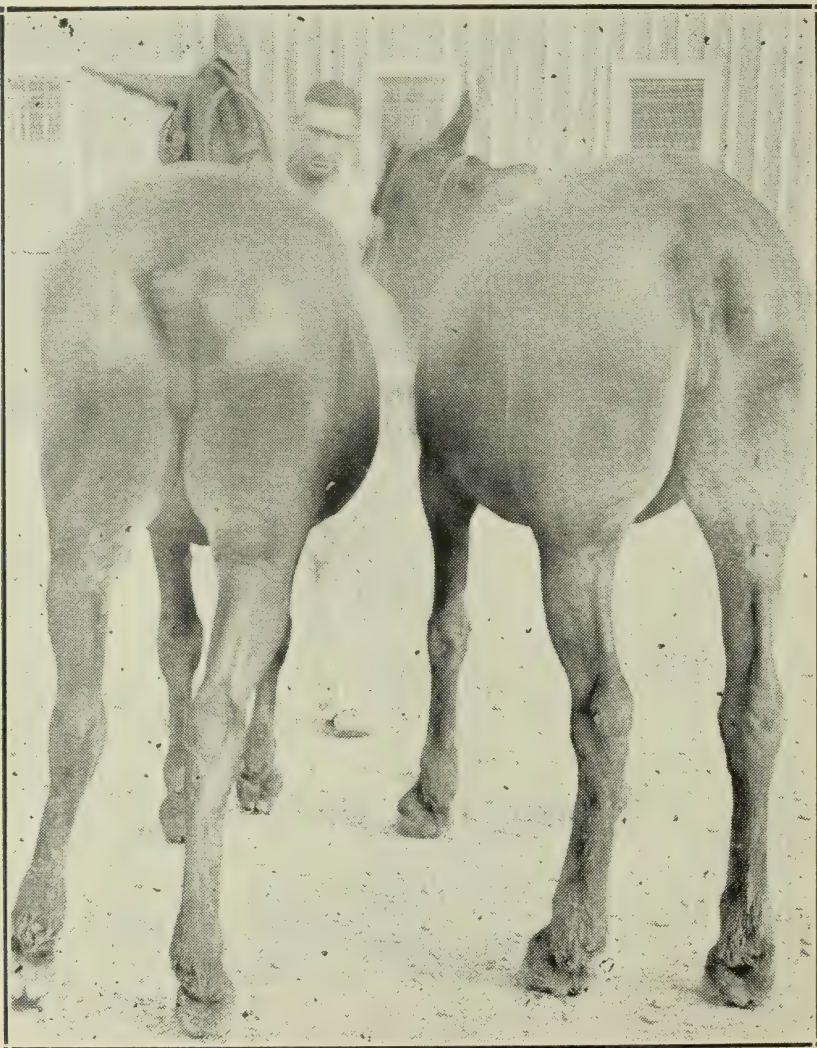


Figure 9. Left, Dolly consumed an average of 3.59 pounds of cottonseed meal and 3.09 pounds of shelled corn daily per 1000 pounds of live weight during the period of April 2-August 1, 1932.

Right, Ollie consumed an average of 2.58 pounds of cottonseed meal and 5.36 pounds of shelled corn during the same period. They are not really bob-tailed. Their tails are OFF after flies.



Figure 10. Left, Jerry consumed an average of 11.4 pounds of shelled corn daily per 1000 pounds of live weight during the period March 13-July 13, 1933.

Right, Tom consumed an average of 4.16 pounds of shelled corn and 3.47 pounds of cottonseed meal daily per 1000 pounds of live weight during the same period.



Figure 11. Left Jerry consumed an average of 11.4 pounds of shelled corn daily per 1000 pounds of live weight during the period March 13-July 13, 1933.

Right, Tom consumed an average of 4.16 pounds of shelled corn and 3.47 pounds of cottonseed meal daily per 1000 pounds of live weight during the same period.

COTTONSEED CAKE AND MOLASSES

In May 1934, Lots 3 and 4 were placed back on test the same as the year before except the mules changed lots and 1 pint of black strap molasses per 100-lbs. of cake was mixed with the cake to make it more palatable. Previous preliminary observations indicated that the addition of black-strap molasses made the cake much more palatable. The results of 1933-34 and the average of both periods are shown in Table VIII, the molasses being omitted in the average. The mules in Lot 3 refused to consume the initial amount of hay.

TABLE VIII.—Corn Alone Compared with Corn and Cottonseed Cake with Black Strap Molasses Mixed In.

Lot No.	Concen- trate Fed	Av. Lbs. Consumed Daily per 1000 Lbs. Live Wt.				Av. Weight per Mule in Pounds			Av. Gain per Mule in Lbs.	Av. No. Days Worked per Mule
		Shelled Corn	C. S. Cake	Rough- age	Molasses	Begin Test	During Test	End Test		
March 13—July 13, 1933										
3	Corn alone --	11.40		11.40		1442	1461	1449	7	79.0
4	Corn & Cake	4.16	3.47	11.98		1434	1391	1352	—82	80.7
May 5—August 5, 1934										
3	Corn alone --	11.50		9.92		1413	1425	1442	29	55.1
4	Corn & Cake	4.02	2.37	11.81	.033	1431	1412	1380	—51	52.5
Av. 1933-1934 periods										
3	Corn alone --	11.46		10.67		1426	1443	1445	19	67.4
4	Corn & Cake	4.09	2.92	11.90		1432	1400	1366	—66	66.6

Table VIII. shows that the mules failed to consume as much cotton seed cake when the black strap molasses was mixed in and did not lose as much weight as in the case of cotton seed cake alone.

COTTON SEED HULLS AND HAY

In 1934 cottonseed hulls were compared with hay as a roughage for farm mules. Lots 1 and 2 each of which consisted of one mule from each of six teams were placed on test May 5 to August 5. The results are shown in Table IX.

TABLE IX.—Cottonseed Hulls Compared with Alfalfa Hay
May 5—August 5, 1934

Lot No.	Roughage Fed	Av. Lbs. Consumed Daily per 1000 Lbs. Live Wt.				Av. Weight per Mule in Pounds			Av. Gain per Mule in Lbs.	Av. No. Days Worked per Mule
		Shelled Corn	C. S. Cake	Roughage	Molasses	Begin Test	During Test	End Test		
1	Alfalfa hay —	5.10	3.30	11.20	.044	1265	1258	1248	—17	52.5
2	Cottonseed hulls -----	5.48	3.08	5.54	.044	1274	1224	1213	—61	52.5

The results of Table IX indicate that farm mules would not consume a sufficient amount of cotton seed hulls to maintain their weight when cotton seed cake was substituted for approximately half of the grain ration.

SUMMARY

The results of ^{eight} ~~seven~~ years of experimental feeding of work mules at the Delta Experiment Station consisting of nine comparisons of feed combinations are presented as follows:

1. When thrashed sagrain and shelled corn were fed to mules at the rate of 12 pounds daily per 1000 pounds of live weight, they were equal in feed value in the combination herein used.

2. Chopping sagrain stover and soybean hay reduced the daily feed requirement per 1000 pounds of live weight from 10.3 to 8.5 and 9.4 to 8.9 pounds respectively. This was probably due to the reduction in waste. Green mature sagrain, heads and stalks, fed at maximum consumption supplemented with 1 and 2.85 pounds of cotton seed meal daily per 1000 pounds of live weight did not maintain the initial weight of the animals, whereas alfalfa hay and shelled corn, with or without cottonseed meal did maintain the initial weight of the comparative animals.

3. In self feeding shelled corn and cotton seed meal, the mules consumed slightly more of these feeds than hand fed mules but slightly less hay. The increased feed consumption in the self fed group was reflected in a 20 pound increase in mule weight in the average of 3 feeding periods.

4. In a ration composed of cotton seed meal or cake, self fed, shelled corn hand fed, and alfalfa hay kept constant at approximately 12 pounds daily per 1000 pounds of live weight, the amount of cotton seed meal or cake consumed varied inversely with the amount of corn fed. In no case however, was the consumption of cotton seed meal or cake great enough to maintain the mules at their initial live weight, but for the quantity consumed one pound of cotton seed meal or cake was equivalent in feeding value to approximately two pounds of shelled corn.

5. When a cotton seed cake-molasses mixture was self fed and the corn ration reduced from 11.5 to 4 pounds daily per 1000 pounds of live weight with the hay unchanged, the mules refused to consume more than 2.37 pounds of the cake-molasses mixture which was contrary to the preliminary result and resulted in an average loss of 80 pounds each compared to the final weight of the corn and hay fed group.

6. When comparing the palatability and feeding value of cotton seed hulls and alfalfa hay in a ration in which corn was kept constant and a cottonseed cake-molasses mixture self fed the animals consumed only half as much hulls as hay with no increase in the consumption of the cake-molasses mixture which resulted in a corresponding loss in weight.

CONCLUSIONS

1. Thrashed sagrain was equal, pound for pound, to shelled corn as a mule feed.
2. When using sagrain stover (the whole plant less the heads) as a roughage for mules, about 18% was saved by chopping.
3. As a roughage, for mules, only about 4.5% of soybean hay was saved by chopping.
4. To maintain mules doing medium work in good condition, green sagrain stalks and heads should be supplemented by other grain.
5. Self-feeding grain kept mules in good condition for maximum efficiency at an additional daily cost of only a few cents.
6. Mules consumed approximately 3 pounds of cotton seed meal or cake daily per 1000-lbs live weight when limited to a half ration of other grain.
7. Mules did not consume more than one pound of cotton seed meal or cake daily per 1000-lbs live weight unless other grain was limited.
8. The addition of blackstrap molasses to cotton seed cake usually makes the cake much more palatable. Sufficient salt to give 1000 pound mules $\frac{1}{2}$ -oz. daily further adds palatability if mixed with the molasses or otherwise added to the cake or meal.
9. To self feed cotton seed cake or meal and hand feed a limited amount of costlier grain is a good practice.
10. One pound of cotton seed cake or meal was equal, in feed value, to approximately two pounds of shelled corn.
11. Farm work mules consumed only half as much cotton seed hulls as alfalfa hay.
12. Ordinarily, it is very economical to use cotton seed cake or meal as half the grain ration for farm work mules.

APPENDIX

COTTON A FOOD AND FEED CROP: Nature made cotton a food and feed rather than a fiber (clothing) plant. Wild cotton has little fiber on its seed. "Enlightened" man in his scramble to cover his nakedness changed cotton to a fiber plant and forgot, for centuries, its food and feed value. Great piles of cottonseed once wasted around gins, and much was dumped into streams where water power was used. Only recently has the real food and feed value of cottonseed products been suspected, and "the half" is not now known. The 84,000,000 pounds of cottonseed cake produced in one Delta county is worth a fourth as much for feed as all corn produced in IOWA'S PREMIER CORN COUNTY. The same Delta county's 33,000,000 pounds of cottonseed oil is WORTH MORE as human food THAN all the PORK AND BUTTER produced in IOWA'S BEST PORK COUNTY.

PRACTICAL, ECONOMICAL MULE FEEDING SUGGESTIONS: The Delta grows more feed in its cottonseed than it has ever dreamed; but it needs, desperately, to learn to economically use its cottonseed products.

According to old standards, with present crop management methods and today's knowledge of and local (lack of) success in carbonaceous grain production, Delta work-mule feeding is very expensive. Unsafe and/or unprofi-

table Delta cotton lands, in their present state of cultivation and improvement, produce abundant leguminous or non-leguminous forage and some grain (as sargrain and/or oats); but sufficient carbonaceous grain to meet ordinarily accepted feeding standards is not now economically produced in the Delta area of the cotton belt.

POOR FEEDING LOSSES: Many Delta MULES are WEAK and HALF STARVED FOR the LACK OF PROPER HAY and ANY GRAIN. Delta workstock are not more than 60% as efficient, on the average as they would be if properly fed and otherwise cared for. Said another way, proper feeding would mean as much as adding 50,000 mules to the Delta's present supply. Proper feeding is cheap compared to losses from working mules unable to "make a day" or do good work, not to mention losses due to "trading in" mules which, had they been properly fed, should still give years of efficient service.

For years the Delta Station has used available facilities to determine, through experiment and observation, economical and safe Delta mule feeding practices. The suggestions given are based on these experiments and observations.

ECONOMY and PROPER FEEDING DEMAND the USE of CAKE (or meal) IN FEEDING ALL Delta MULES and the use of some HULLS IN FEEDING THOSE for which ABUNDANT HAY is NOT GROWN.

DOLLARS AND CENTS ECONOMY: The DELTA (and other Southern areas having insufficient other grain) should WINTER AND FATTEN its MULES ON COTTONSEED CAKE (or meal) AND HAY for four reasons: 1. A POUND OF CAKE (or meal) is WORTH as much as mule feed as 2 pounds of CORN or oats. 2. A DOLLAR spent for cake (or meal) usually BUYS as MUCH FEEDING value as \$1.50 to \$3.00 SPENT FOR CORN or oats. 3. Using cake consistently from year to year will help maintain fair prices for cottonseed. 4. Available CORN, oats, etc., can and should be SAVED FOR the four to five months of VERY HARD spring and summer WORK when a half ration of other grain than cake seems necessary.

GENERAL SUGGESTIONS: Fresh, pure water should be available at all times. All troughs should have underground drains to carry off excess water. Outside troughs should be on high ground protected by cinders, brickbats, gravel, or other mud-preventing surface. Knee-deep mudholes around watering troughs are very expensive even if they do not distribute infectious diseases.

Mules should have shelter and should be confined under same at night and in bad weather. Much feed is required to offset lack of protection from rain and cold. Trudging over a muddy lot requires much feed-energy.

Grain-tight mangers (double bottoms help) are essential to economical feeding. Wide (3 ft. or more) mangers are less wasteful than narrow ones. Hay racks should be behind and a part of grain mangers where practical, so that dropped hay will fall in the manger and be eaten instead of being wasted. Mangers in which shelled or ground grain is fed should have 2x2 inch timbers nailed two inches apart in their bottoms to prevent bolting and colic.

Many planters hesitate to feed cottonseed hulls to mules. Cattle feeding tests show hulls to be worth as much or more than Prairie and other low-grade non-legume hays. If roughage must be bought, Delta mules can safely and economically consume reasonable amounts of properly supplemented hulls.

Grinding corn or chopping roughage are doubtfully economical unless equipment is already installed. Waste is minimized, and mixing with cottonseed meal or other feeds is facilitated, however.

Blackstrap molasses makes rough feeds and cottonseed cake more palatable but is usually expensive per unit of digestible nutrients.

Buying shelled corn is more economical than the common practice of buying snapped or husked corn. Definite grades are possible, and freight is much less.

ALL MULES IN BAD CONDITION should be treated for internal (and external if necessary) parasites. (See your county agent and/or local veterinarian for treatment details) Their teeth should be inspected and given necessary attention. Special feed such as a mixture of equal parts of ground corn, cottonseed meal, and shorts, with good chopped alfalfa or alfalfa hay may be necessary; but fall or winter is the time to fatten and prepare all mules for work.

Suggested Delta Rations

FOR IDLE MULES: 1. If plenty of home-grown hay is available for a year, feed 1-1/4 lbs. of hay daily per 1000-lbs. live weight (figured when mules are in good condition) and cottonseed cake, ad libitum—(all the mules will eat). 2. If any hay must be bought, use 1/2 lb. hay per 1000-lbs live weight and a mixture of 200 lbs. cottonseed hulls and 100 lbs. cottonseed meal, ad libitum. 3. If all feed must be bought, 1/4 lb. to 1/3 lb. good hay per 1000-lb live weight daily and a mixture of 300 lbs. cottonseed hulls and 100 lbs. cottonseed meal ad libitum. If mules do not fatten, add 1/2 to 2 gallons (depending upon relative prices) of blackstrap to 400 lbs. of the hulls-meal mixture. When mules must do occasional winter work, feed 3 to 6 lbs. (depending upon the class of work) of other grain per head daily in addition to the idle ration.

FOR WORK MULES: 4. With plenty of hay available: 1-1/4 lbs. of hay and 1/2-lb. of corn or oats daily per 1000-lb. live weight—cottonseed cake ad libitum. 5. If any hay must be bought: 3/4 lb. of good hay and 1/2 lb. of corn or oats daily per 100 lb live weight—a mixture of 500 lbs. cottonseed hulls to 400 lbs. cottonseed meal, ad libitum. One quart of black strap per 100 lbs. of the hulls-meal mixture will make it more palatable. Cracked cake (quail-egg size) is more satisfactory except for mixing with hulls or other feed than cottonseed meal. It is ideal for use in self-feeders. The addition of a pint to a quart of blackstrap per 100-lbs. of cake adds palatability.

All feeding should be done under shelter. Rotten feed kills quickly. One good mule saved will build considerable shelter. Where self-feeders are not used, feed only as much cake or other feed as the mules will clean up daily. Spoiled feed is dangerous.

The average 1000-pound Delta work mule can be kept in efficient work condition for 12 months on 20 bushels of corn (or an equal weight of thrashed sagrain, oats, or soybeans): 2-1/4 tons of good alfalfa, soybean, or other legume hay; and 1200 lbs. of cottonseed cake or meal. The hay and cake or meal requirements can be reduced materially by proper use of pastures.

PASTURES FOR MULES

Delta stalk fields, small grain, winter legume, and alfalfa fields should be pastured when not too wet. Nothing is so satisfactory, considering economy, for fattening and "carrying" mules through the summer and fall idle period (July 15 to December 20) as 1-1/2 acres of sagrain and Mamredo (for plantings previous to May 1) and Mamloxi (for later plantings) soybeans pasture

per head. If this pasture is planted on good land or well fertilized, the acreage may be reduced 25 to 50%. If fencing is not too expensive, small areas (1/4 acre per mule) should be pastured clean before "turning in" on other areas. One-fourth acre of good and well fertilized land per mule near the barn for sagrain and soybeans in summer and fall, and wheat or rye and vetch in winter and spring will pay well. This area may be utilized for mules which must be kept at the barn the year 'round.

For each four mules kept, an acre of permanent pasture on good or well-fertilized land adjacent to the barn lot will pay any plantation. The following per-acre seedings on well prepared land are suggested. The last 10 days of March, Bermuda sod 4x4 ft., 2 lbs. white clover, 6 lbs. lespedeza, 6 lbs. carpet grass, 6 lbs. Dallis grass (imported seed preferred), and 25 lbs. Sudan grass to make pasture the first year. Apply barnyard or stable manure or 300 lbs. of commercial nitrogenous fertilizer per acre before planting. About August 15 sow on the pasture 2 lbs. hop clover, 5 lbs. black medic, and 10 to 20 lbs. unhulled burr clover per acre and follow with a section harrow. In future years fertilize sufficiently to give grasses a rich green color in seasonable weather.

The adoption of the above feed and pasture program will make the Delta feed-independent.

Monthly saving in dollars from feeding each of ten 1000 lb. mules 5 lbs. of corn (or threshed sagrain or oats) and 3 1/2 lbs. of cottonseed cake (or meal) and 12 lbs. of hay instead of 12 lbs. each of corn (or threshed sagrain or oats) and hay daily.

Cts. per bu. for corn	Dollars per Ton for Cottonseed Cake (or Meal)									
	12.00	14.00	16.00	20.00	25.00	30.00	35.00	40.00	50.00	60.00
25	3.07	2.02	0.97	-1.13	-3.76	-7.13	-9.88	-11.63	-16.88	-22.13
30	4.95	3.90	2.85	0.39	-1.88	-5.25	-8.00	-9.75	-15.00	-20.25
35	6.82	5.77	4.72	2.62	-0.01	-3.38	-6.13	-7.88	-13.13	-18.38
40	8.70	7.65	6.60	4.50	1.87	-1.50	-4.25	-6.00	-11.25	-16.50
45	10.58	9.53	8.48	6.38	3.75	0.38	-2.37	-4.12	-9.37	-14.62
50	12.45	11.40	10.35	8.25	5.62	2.25	-0.50	-2.25	-7.50	-12.75
55	14.33	13.28	12.23	10.13	7.50	4.13	1.38	-0.37	-5.62	-10.87
60	16.20	15.15	14.10	12.00	9.37	6.00	3.25	1.50	-3.75	-9.00
70	19.95	18.90	17.85	15.75	13.12	9.75	7.00	5.25	0.00	-5.25
80	23.70	22.65	21.60	19.50	16.87	13.50	10.75	9.00	3.75	-1.50
90	27.45	26.40	25.35	23.25	20.62	17.25	14.50	12.75	7.50	2.25
100	31.20	30.15	29.10	27.00	24.37	21.00	18.25	16.50	11.25	6.00
115	36.83	35.78	34.73	32.63	30.00	26.63	23.88	22.13	16.88	11.63
130	42.45	41.40	40.35	38.25	35.62	32.25	29.50	27.75	22.50	17.25
145	48.07	47.02	45.97	43.87	41.24	37.87	35.12	33.37	28.12	22.87
160	53.70	52.65	51.60	49.50	46.87	43.50	40.75	39.00	33.75	28.50
180	61.20	60.15	59.10	57.00	54.37	51.00	48.25	46.50	41.25	36.00
200	68.70	67.65	66.60	64.50	61.87	58.50	55.75	54.00	48.75	43.50
225	78.07	77.02	75.97	73.87	71.24	67.87	65.12	63.37	58.12	52.87
250	87.45	86.40	85.35	83.25	80.62	77.25	74.50	72.75	67.50	62.25

The above table is based on 1500 lbs. of corn and 1050 lbs. cottonseed cake replacing 3600 lbs. of corn in feeding work mules.

H I N D S

A Comparison of the Tube, Rapid Serum, and
Rapid Blood Drop Agglutination Tests
for the Detection of Carriers of
Salmonella Pullorum

By

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J. R. RICKS, Director

**A COMPARISON OF THE TUBE, RAPID SERUM, AND RAPID BLOOD DROP
AGGLUTINATION TESTS FOR THE DETECTION OF CARRIERS
OF SALMONELLA PULLORUM***

By

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Salmonella Pullorum or *Bacterium Pullorum* was first described by Rettger (1900), though at that time the disease was known as Septicemia instead of White Diarrhea.

Rettger and Harvey in (1908) working with the same organism demonstrated its identity with the disease commonly known as White Diarrhea by the fact that the serum of chicks inoculated with killed cultures would agglutinate the homologous organism.

Jones in (1911) showed that chicks recovering from the original infection may carry the organism in their ovaries. Therefore, in light of available information. Jones suggested the use of the agglutination test for the detection of adult carriers of this disease.

Jones (1911 & '12) described the macroscopic agglutination method of testing fowls to determine the carriers of *Bacterium* or *Salmonella Pullorum*. He also described the method of collecting the blood samples and for making the antigen or testing fluid. He reported twenty-one birds as giving a positive reaction to the test and was able to isolate the organism from the ovaries of twenty of these birds.

This agglutination test as developed by Jones has been widely used for testing flocks in order to eliminate the adult birds carrying the infection, and has been generally accepted as the standard test.

Ward and Gallagher (1917) announced the discovery of the intradermal or pullorin test. This test consisted of the injection of a carbolyzed culture in the wattle. At the expiration of thirty hours readings were made and a swelling was expected in the wattles of infected birds. In their experiment 90 per cent of the artificially infected birds reacted to the test. About 6 percent failed to react from which the organism was recovered and 3 per cent failed to react in which the organism was not recovered, which was as expected.

Field experiments conducted with the intradermal and agglutination tests failed to agree when the reading was made 38 hours after injection. In another experiment the two tests were in agreement in 70 percent of the cases.

The intradermal test has not shown up very favorably when compared with the agglutination tube test as shown by the following references:—

Edwards and Hull 1927 compared the agglutination and intradermal tests in which they report very poor correlation results, indicating the agglutination test to be much more reliable for detecting carriers of *Bacterium Pullorum* than the intradermal test.

Michael and Beach (1929) considered the agglutination test more satisfactory than the intradermal with pullorin.

Graham, Tunnick, and McCulloch (1928) found the intradermal test to agree with the agglutination test in 66.9 percent of the cases.

Rettger, McAlpine and Warren (1930) found the intradermal test to give results which often failed to agree with those obtained by the agglutination methods. The differences were most marked with the negative groups and were so great in the second experiment as to render the method as applied useless.

Stafseth and Thorp (1928) in comparing the agglutination and Pullorin tests, found the pullorin test decidedly inferior.

*Note: The work reported in this bulletin was completed in February 1931, and the manuscript prepared and submitted to the Director on March 1931. Due to changes in personnel and a drastic reduction in Experiment Station funds, publication has been delayed.

Runnells, Coon, Farley, and Thorp (1927) reported the application of the rapid method of agglutination. This method differs from the tube method in that a small quantity of blood serum is placed on slide or pane of glass to which is added a drop of highly concentrated antigen (density about 50 times McFarlane's No. 9). If positive the reaction takes place in one-half to one minute with a distinct clumping throughout the sample.

Gavarkin (1928) reported the tube and rapid agglutination tests equally satisfactory for the detection of B. W. D. carriers.

Beach and Michael (1929) found the tube method and rapid serum method equally reliable for performing the agglutination test.

Stafseth and Thorp (1928) from results obtained in using the rapid agglutination predicted that it may become the most useful and practical test for controlling Bacillary White Diarrhea.

Bunyea, Hall, and Dorset (1929) brought forth still another method of applying the agglutination test, which was described as a rapid field agglutination test. This method is commonly spoken of as the rapid blood drop test and differs from the rapid serum test, in that whole fresh blood is used in the former, blood serum in the latter. The authors called attention to the fact that this method overcomes some of the difficulties encountered with other methods, such as time element, re-handling of fowls, necessity for drawing large blood samples and spoilage of blood sample in transit.

Beach and Michael (1930) reported work based on method devised by Hall, Dorset, and Bunyea in which 3,727 birds were tested. Results reported showed 43 fowls reacting to slow test, 57.5 percent of which reacted to blood drop test and 39 percent reacted to blood film test. Results were secured which varied when different dilutions were used on the same samples.

Sawyer and Hamilton (1930) conducted tube and whole blood tests at four week intervals on thirty birds in conjunction with two other laboratories. They found the results of the two methods to be identical, each showing 15 positive and 15 negative hens.

The rapid blood drop test has been used for two years on the Mississippi Station flocks. In 1929 and 1930, four positive reactors were found in the 150 birds tested. All of these gave positive reactions to the tube test. In 1930 and 1931 five positive reactors were found in the 375 birds tested. All of these gave positive reaction to the tube test. The 370 birds giving negative reaction were all re-tested by the rapid blood drop method about six weeks later and gave 100 percent negative reaction. To date the chick mortality has been 5.3 percent out of a total of 1,203 chicks. These chicks are now from one to seven weeks old. We have been unable to show White Diarrhea to be responsible for the death of any of the chicks.

PURPOSE OF STUDY

To determine the efficiency of the rapid blood drop agglutination method for detecting carriers of *Salmonella pullorum*. The tube and rapid serum agglutination methods were used as a check to determine efficiency, and to give a direct comparison of the results of the three methods.

EXPERIMENTAL METHODS

In this study a total of 1,250 birds (hens, mature pullets, and males) were tested by the three agglutination methods. This work was done during the fall and winter seasons of 1929-1930 and 1930-1931.

The antigen used in conducting the tube test was prepared from four pure strains of *Bacterium pullorum*. The method of preparing the antigen was the same as that described by Gage and Paige (1915) except that NaOH was added. In the first season's work four dilutions, 1-400, 1-200, 1-100, and 1-30 were used. The results of the four checked very closely, but the 1-30 dilution gave slightly better reaction and was used exclusively in the second season's work. The technique of Jones (loc.cit) for carrying out the test was used in the first season's work and that of Beaudette (1923) in second season's work.

Some of the antigen used for the rapid serum and rapid blood drop tests was secured from a commercial laboratory, some from the department of Bio-Chemistry, Washington, D. C. through the courtesy of Dr. Bunyea, and some was prepared in the Mississippi State College laboratory. All of this antigen, regardless of source, was prepared by the method devised by Bunyea, Hall, and Dorset (loc.cit). It should be noted, however, that the commercial antigen was free of color, while that from the department at Washington and the Mississippi State College laboratory was colored. In conducting both the rapid blood drop and the rapid serum tests, one drop of blood or serum was placed on a pane of glass to which was added one drop of antigen, the two were then stirred together or rotated.

Sixteen flocks embracing 1,250 birds in the territory around the College were used in making these tests. The rapid blood drop test was conducted under field conditions on the farms represented. At the same time a sample of blood was collected from each hen and numbered to correspond with that of the leg band number placed on the hen. The positive or negative reaction of the blood drop test was also recorded on the label of the blood sample by a plus or minus sign. These samples were taken immediately to the laboratory and kept in a refrigerator until sufficient blood serum was available for the tests. A permanent record was made of the results of rapid blood drop test made in the field. This record also contained columns for recording the results of the serum tests. To insure accuracy in conducting the rapid serum test, blocks were used and numbered by rows, six rows deep and twelve rows long, holding seventy-two samples. The pane of glass was lined off in squares with rows corresponding to those of the blocks.

RESULTS

Table I

Table showing total Negative and Positive Reactors (by flocks) of Rapid Blood, Rapid Serum, and Tube Agglutination Tests for *Bacterium Pullorum*.

Flock Number	Positive Reactors				Negative Reactors			
	Number Birds	Rapid Blood	Rapid Serum	Tube Agglu.	Rapid Blood	Rapid Serum	Tube Agglu.	
1	92	2	2	3	90	90	89	
2	236	17	18	16	219	218	220	
3	57	27	28	29	30	29	28	
4	36	10	10	11	26	26	25	
5	114	34	35	37	80	79	77	
6	47	17	21	9	30	26	38	
7	63	22	24	21	41	39	42	
8	72	35	39	38	37	33	34	
9	59	10	10	9	49	49	50	
10	88	31	31	32	57	57	56	
11	34	8	12	11	26	22	23	
12	38	5	8	7	33	30	31	
13	60	10	11	10	50	49	50	
14	50	16	15	16	34	35	34	
15	108	5	6	6	103	102	102	
16	96	16	15	13	80	81	83	
Total	1250	265	285	268	985	965	982	

Table One shows the number of flocks tested and the positive and negative reactors to the three methods. It will be noted that the smallest number of positive reactors (265) occurred with the rapid blood drop method, the second smallest (268) with the tube, and the largest (285) with the rapid serum. Expressed in terms of percent positive of total numbers tested, we have for rapid blood drop 21.2 percent, for rapid serum 22.8 percent and for tube 21.44 percent. These figures represent a slight variation in the results of the three tests, leaving very little choice in the methods when the total average results are considered. However, the individual variations occurring between the methods should be a more accurate indication or means of measuring the true efficiency of the different methods than a total average of results secured.

In checking up we find there is a variation of 31 between rapid blood drop and tube, 31 between rapid serum and tube, and 24 between rapid blood drop and rapid serum, or 2.48 percent, and 1.92 percent respectively. Here again we have a rather

close correlation of results, but a considerably greater variation than in the comparison of total average results.

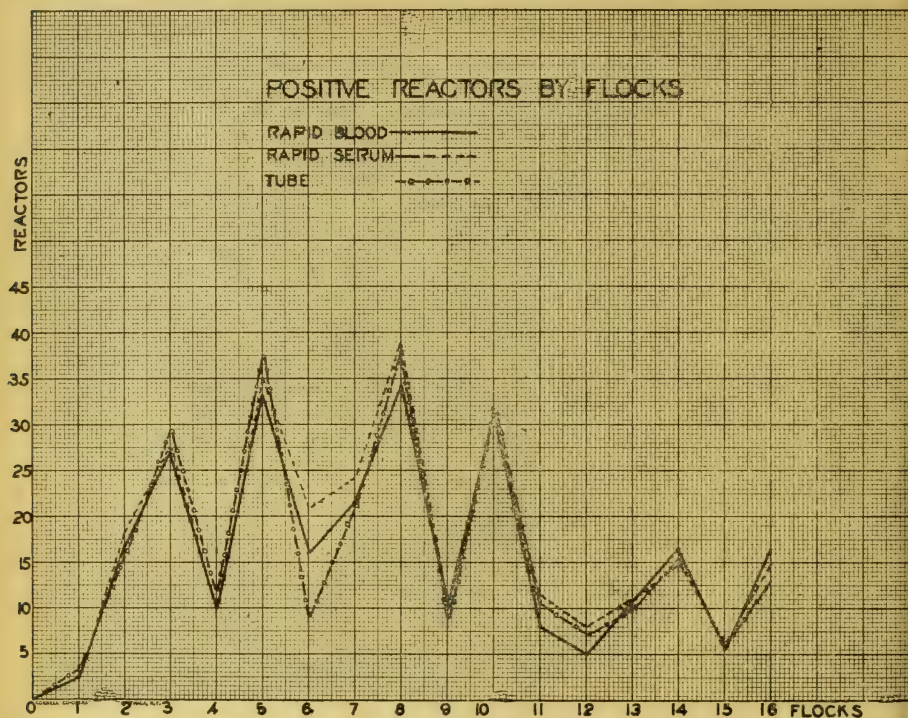


Chart 1 shows graphically the relationship between the positive reactors by the three methods by flocks. It will be noted that there is very little spread between the three curves.

Of the 1,250 birds tested, 77 were males. Two of these, or 2.63 percent, were positive to the rapid blood drop and rapid serum tests, while one was positive and one negative to the tube test. Hence, one male gave positive reaction to all three tests and the other positive to both rapid tests and negative to tube.

Some observations and experiences in applying the rapid blood drop test under field conditions, we feel, are worthy of recording.

Dust particles did not prove to be serious enough to cause the test to be misinterpreted, especially when colored antigen was used. However, it is desirable to do the testing on a table about three feet high, and placed some distance from the poultry house, with any breeze from table toward the house. The helper should remove feathers from under the wing and quiet the bird before approaching the testing table. The observance of these suggestions will reduce the quantity of dust and foreign particles to the extent that it will not interfere with the test in the least.

We also observed that in all cases where the reaction took place immediately in the rapid blood drop test, that the results checked with those of the other two methods in almost all cases. The slow and questionable reactors to the rapid blood drop were also slow and questionable reactors to the tube test. The rapid serum test was more definite in positive reactions on these birds than either of the other two methods as evidenced by the fact that more positive birds (285) were recorded by this method.

It was found that a cold testing surface and low temperature retarded the reaction with the rapid blood drop test, warm weather or artificial heat being necessary to satisfactory tests.

In securing the sample the blood should be taken as it comes from the vein and the antigen applied before coagulation takes place. If coagulation is permitted it is more difficult to read the reaction.

For best results the antigen must be shaken thoroughly at frequent intervals, especially if colored antigen is used.

The clumping in positive reactors was more pronounced with colored antigen and the results checked more closely with the rapid serum and tube tests. A dark background was unnecessary when the colored antigen was used.

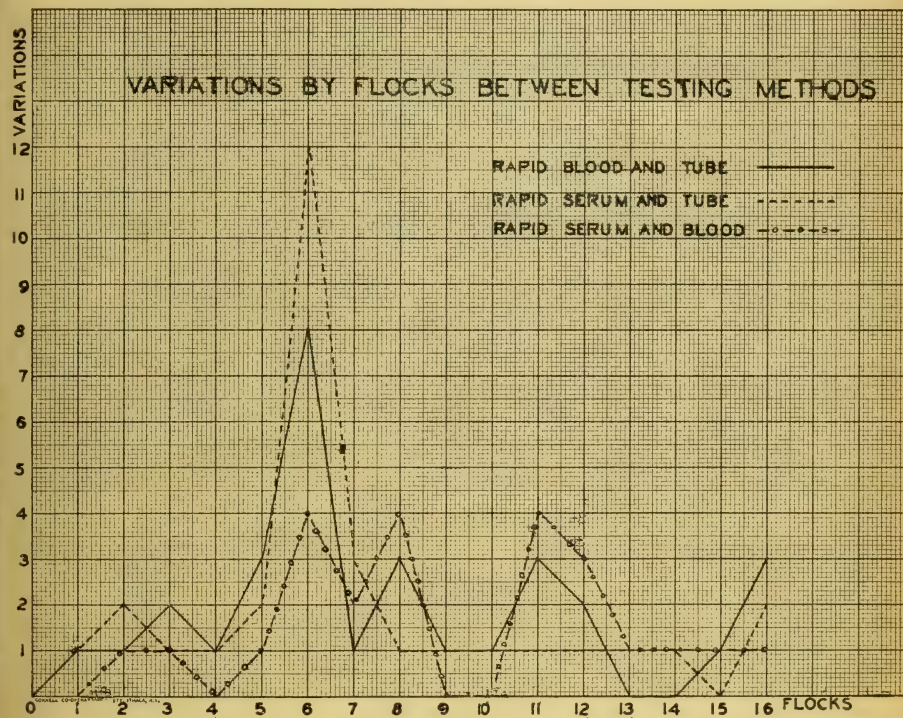


Chart two shows individual variations between the rapid blood drop, tube, and rapid serum tests.

DISCUSSION

In the historical review given in this paper (loc-Cit) the four known methods for detecting carriers of *Bacterium pullorum* were considered. The results as reported by numerous workers show the tube method to be extremely valuable in the detection and eradication of White Diarrhea. The close agreement of results secured by the use of the tube method has led to the adoption and acceptance of this method as the standard for conducting the test. It should be pointed out, however, that this method has failed to give identical results when applied by different individuals on blood samples from the same hen. In like manner variations between the results of the test, post-mortem findings, and recovery of the organism from birds having given positive reactions have been reported by numerous workers. It has been shown that this method, if used at frequent intervals in conjunction with sanitary precautions, will rid a flock of the disease. While this method of testing has been adopted as standard and will eradicate the disease from a flock, it is not, by any means, infallible.

The results reported show marked variations between the intradermal and the tube test. The conclusion reached in most cases is that the intradermal test is not satisfactory for the detection of carriers of *Bacterium pullorum*. Furthermore, the injection of the pullorin has been shown to interfere with subsequent tests conduct-

ed by the tube agglutination method. Then it seems that this method in its present state of development might be eliminated from consideration as a reliable or desirable method for the detection and eradication of white diarrhea from poultry flocks.

The rapid serum method as reported by Runnels, Coon, Farley, and Thorp has been checked by several stations. This method has given uniformly good results in comparison with the tube method. The conclusion having been reached that this method is as reliable as the tube method for detecting carriers of *Bacterium pullorum*. Several workers have predicted that this method might become the most practical and useful of the two.

Bunyea, Hall, and Dorset reported the rapid blood test in 1929. So far as we know these workers have not reported any comparative data in connection with this and other agglutination methods of testing.

The California Station reported some comparative work on the tube, rapid blood drop and rapid blood film tests in 1930. Their results showed that slightly over half of the birds giving positive reactions to the tube method gave positive reactions to the blood drop and slightly over one-third to the blood film methods.

In contrast to the results reported by the California Station, the Western Washington Station in conjunction with two other laboratories, found complete agreement between the results of the rapid and tube methods. While there were only thirty birds tested by the Washington Station as against 3,727 at the California Station, the fact that three laboratories reported identical results would in a measure compensate for the difference in numbers.

The two citations referred to seem to be the only available data other than that reported in this paper on the comparative efficiency of the tube and rapid blood drop methods for detecting carriers of *Bacterium pullorum*. Of the three reports the California Station results show a rather wide variation in results secured. The Washington Station report shows complete agreement by three laboratories in results secured, and the results of the work reported in this paper show a very slight variation in results obtained by the rapid blood drop, rapid serum, and tube methods.

In our work there were 31 individual variations between the reactions given by the rapid blood drop and tube tests. Of these there were 17 negative to rapid blood drop and positive to tube, 14 positive to rapid blood drop and negative to tube.

There were 31 individual variations between the reactions given by the rapid serum and tube tests. Of these there were 7 negative to rapid serum and positive to tube, 24 positive to rapid serum and negative to tube.

There were 24 individual variations between the reactions given by the rapid blood drop and rapid serum tests. Of these there were 22 negative to rapid blood drop and positive to rapid serum, 2 positive to rapid blood drop and negative to rapid serum.

There was a very small variation between the three testing methods in the total number of positive and negative reactors as shown in Table I, the rapid serum showing 25 more birds positive than rapid blood drop, and 17 more birds positive than tube. In individual variations there were 31 birds showing a different reaction between rapid blood and tube, the same number (31) between rapid serum and tube, and 24 between rapid blood drop and rapid serum. Each of the rapid tests in comparison with the tube gave a slight increase in individual variations over the combined totals, but in comparison with each other a decrease. In all three methods the individual variations even though slightly larger than the totals suggest less practical difference because the variations were not all positive or negative, being 17 negative, 14 positive between rapid blood drop and tube; 7 negative, 24 positive between rapid serum and tube, and 22 negative, 2 positive, between rapid blood drop and rapid serum. In individual variations the smallest difference occurred between the two rapid methods, 24 against 31, between both rapid methods and tube. This difference may not be especially significant, but is certainly not unfavorable to the rapid blood drop method. The close agreement of results secured by all three methods suggest a high degree of efficiency for all methods in detecting carriers of *Salmonella pullorum*.

Efficiency is not the only index to the value of a testing method. Economy of

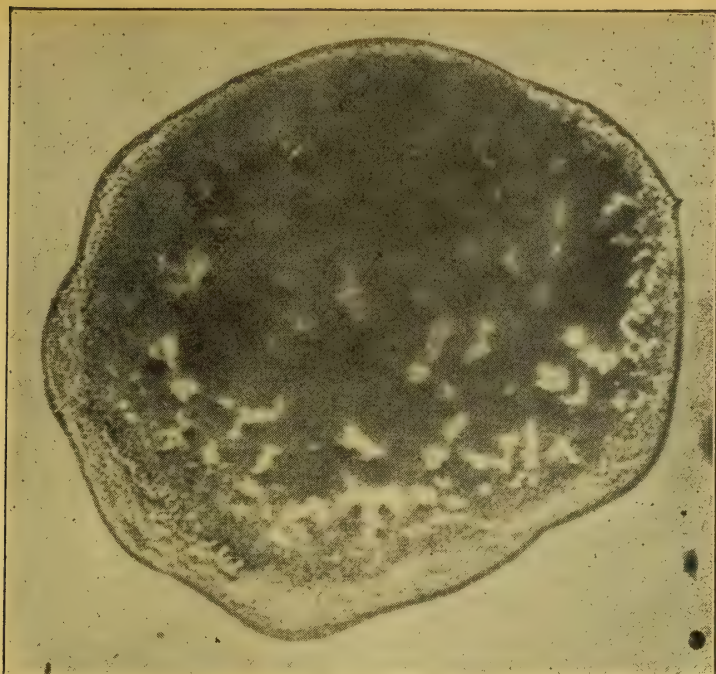


Illustration No. I. The above is a photograph of a positive reaction.

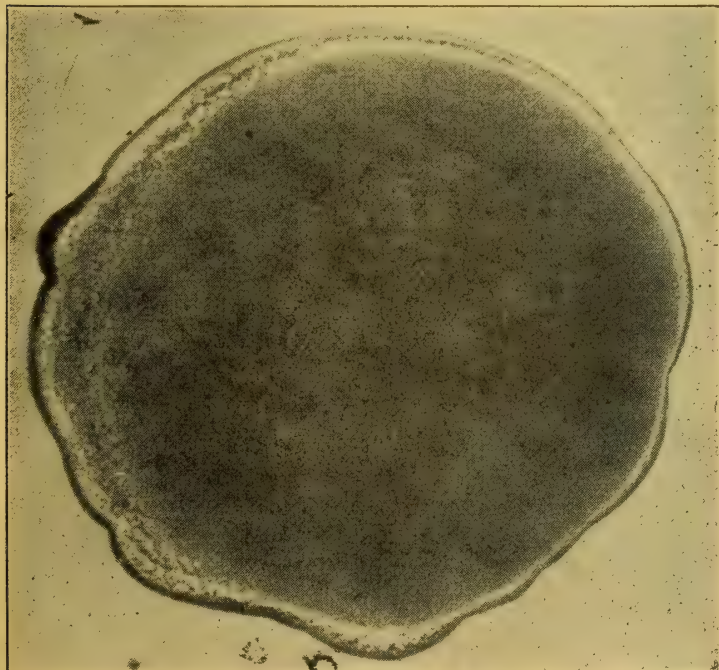


Illustration No. II. The above is a photograph of a negative reaction.

time, labor, and money are also important factors. In addition the possible spoilage of samples and errors in technique must be considered.

The results obtained with the rapid blood drop from the standpoint of efficiency, as measured by the two comparative tests, and the actual results in the field, especially on the College flocks, as measured by a complete negative set of reactions on subsequent test and the livability of the chicks from the community flocks as well as the college flocks, are apparently in agreement. The advantages of the simplified rapid blood drop method have been outlined by those (loc.cit) discovering the method, and no explanation of it is essential here. These advantages along with the efficiency as shown in our comparisons indicate unquestionably that this method is deserving of much consideration of those interested in the practical control and eradication of white diarrhea.

CONCLUSIONS

1. Comparative tests between the rapid blood drop, rapid serum, and tube methods gave very slight variations between the total average positive and negative reactions.

2. There were 31 individual variations between the results of the rapid blood drop and tube, 31 between rapid serum and tube, and 24 between rapid blood drop and rapid serum methods.

3. Colored antigen gave a much more conclusive or positive test than clear antigen.

4. The rapid blood drop method was found to be practical and efficient under field conditions.

5. The rapid blood drop method was more economical in time, labor, and money, than the tube or rapid serum tests.

6. The rapid blood drop method when applied to the Mississippi Station flock detected five reactors on the first test, and no reactors on second test six weeks later. The mortality of chicks from these flocks has been 5 percent with no indications of white diarrhea.

7. In view of the fact that the rapid blood drop method was found to be practical, efficient, and economical, it appears that this method should be given recognition by being placed on a parity with the tube and rapid serum methods, and that it might be recommended to the poultry breeders as a reliable, practical method for detecting carriers of *Bacterium Pullorum*.

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THE ECONOMIC VALUE OF IMPROVED COTTON SEED

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THE ECONOMIC VALUE OF IMPROVED COTTON SEED

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INTRODUCTION

The value of good seed in the production of farm crops has been stressed by plant breeders and agronomists for many years. This has been especially true with regard to the staple farm crops among which cotton occupies a prominent place.

Although it was known to scientific workers and to many cotton growers that the use of improved seed was conducive to larger yields and higher quality of product, the difficulty of maintaining the purity of seed stocks on the farm and the tendency for local buyers to pay average prices regardless of quality, greatly minimized and sometimes obliterated any advantage which the use of improved seed might have given the farmer.

To overcome these difficulties, the idea of the "One Variety" cotton community was advanced. Such an arrangement makes it possible to better conserve the purity of seed stocks by arranging for special gin days or by confining all operations of a particular gin to the chosen variety; it reduces the deterioration of seed stocks through hybridization to a minimum; and it is conducive to higher average local prices because of a higher average quality of the cotton produced in the community.

Early efforts at organizing such communities in Mississippi met with little success, but with the continued decline in cotton prices following 1929, cotton farmers began to look for ways in which they might halt the decline in the income customarily obtained from cotton. When in the fall of 1930, numerous farmers producing extremely short staple cotton had difficulty in marketing their crop at any price, the time seemed propitious for undertaking a concerted cotton improvement program. Eighteen "One Variety" cotton communities were organized in the spring of 1931 through the combined efforts of Mississippi State College, the State Department of Agriculture and Commerce, the Farm Service Bureau, the Mississippi Cotton Cooperative Association and the Federal Bureau of Plant Industry operating through a Crop Improvement Committee. The number was more than doubled the following year. The project here reported was undertaken to determine the profitability of planting improved seed.

METHOD

Enterprise cost records were obtained by personal interview in the spring of 1933. Ordinarily, the farmer gave the information from memory. Only occasionally was a farmer interviewed who had a written record of any kind.

As comparative, rather than specific, costs were desired, each farmer interviewed was considered as the land owner although some rented the land operated and others worked the cotton crop with share-cropper labor.

Seed for the crop was entered at actual cost if purchased and at opportunity value if raised. Commercial fertilizer was entered at cost, the hauling charges being contained in "Other labor" and "Horse work." Manure was charged at the farmers' estimates of its value. Ginning and wrapping were charged at actual cost except where ginned for a toll in which case the value of lint and seed taken as toll was calculated and used. Picking was charged at the usual rate for the community as indicated by the farmer interviewed. Other labor was entered at the flat rate of ten cents per hour. Nine cents per hour was used for all horse work, while two cents per hour, based on hours of horse work, was charged for the use of machinery. Truck use was charged at twenty cents per ton mile and one dollar per hour was charged for tractor use, both including the labor of the driver. One-fourth of the value of products was charged for the use of land in all cases.

Values of products per acre were determined from prices received if they had been sold or from the current market price less holding charges if they were still on hand.

The cost per pound of lint was determined by deducting the value per acre of seed from the total cost per acre and dividing the remainder by the pounds of lint per acre.

For tabulating, the records were first sorted according to the generation of the seed. Sub-sortings were on the bases of variety and the amounts of fertilizer used. A uniform method of tabulating was used, odd numbered tables showing money values and succeeding even numbered tables showing quantity data and miscellaneous calculations and values.

Because of the method and the values used, all growers show a loss on the cotton enterprise. Were the one-fourth of the value of the crop not added in the cost, such losses would be materially reduced. Picking and other labor was usually performed by the family or share cropper labor and was not a cash outlay. Manure, where used, was valued too high in the opinion of the author. While the farmer's cotton crop brought him a very small return and his financial condition was not to be envied, it was not so bad as the loss figures would lead one to believe at first glance. The data are intended to be comparative and not actual. When so used they serve their purpose.

RESULTS

Tables 1 and 2 show comparative data when the records were sorted on the generation of seed used. Costs per acre as shown in Table 1 trend definitely downward for the first, second and third generations, while fluctuations occur in succeeding generations. Values of products follow the same order, but to a greater degree which results in losses per acre increasing as the seed stock becomes older. Prices per pound received for lint show a constant decrease from the first to the fifth and older generation seed. Costs per pound of lint vary with costs per acre.

It is evident from these data, data of subsequent tables and examinations of lint and seed that planting seed degenerates to the extent where fourth generation seed is little, if any, better than ordinary gin run seed even when fairly good care is taken at the gin and in the field. This accounts for the fluctuations after the third generation.

Table 2 shows quantities and miscellaneous calculations and values. It shows that larger quantities of seed were used per acre as seed stock became older. This might be expected as such seed would be less costly and perhaps they would contain more immature seed and foreign matter.

Lint percentage trended definitely downward.

Yield of lint per acre decreased to the third generation after which it fluctuated up and then down. It was thought that this might be a result of fertilizer used which, it will be observed, shows a steady decrease from the first to the fifth and older generation seed. This is not wholly true as may be observed in later tables.

The organized communities all adopted varieties of cotton normally stapling 15/16 inch or longer. Only three varieties were chosen. These were Stoneville, Delta and Pine Land and Rowden. One community chose the latter variety. In order to test the data where single varieties were involved, the records were sorted on variety and tabulations were made.

Tables 3 and 4 show the results for Stoneville cotton for three generations. The value of planting improved seed is clearly evident. The only apparent inconsistency in the data occurs for lint percentage, Table 4.

Tables 5 and 6 show similar data for five generations of Delta and Pine Land cotton, the fourth and fifth generations being combined. Here the trend is not so

consistent, as second generation is shown to be more profitable than first, while the loss on first generation seed was only six cents per acre less than that on the fourth and fifth combined. The users of first generation seed had a higher cost than had those using older seed which a higher yield failed to overcome, partly because of a failure to receive appreciably better prices. The outstanding trend in these data is that of lint percentage which is markedly and consistently downward.

The data dealing with Stoneville and Delta and Pine Land cottons are not comparable for determining the relative merits of the two varieties. All Stoneville records were obtained in the northern part of the state in Alcorn, Union and Tippah counties, while practically all Delta and Pine Land records were obtained in the southern part of the state in Jones, Forrest, and Simpson counties. Thus, the two varieties were produced under different conditions of soil and climate. In addition, more manure was used in the northern part of the state and in the same area a part of the cotton was ginned for toll which, with low cotton prices and the method of computing gin charges, gave the northern growers a lower ginning charge.

It has been observed, Table 2, that the quantity of commercial fertilizer used per acre decreased with succeeding generations of seed. A partial elimination of the influence of fertilizer on the results was obtained by sorting the records on the basis of fertilizer used.

Tables 7 and 8 contain data for 54 crops on which neither commercial fertilizer nor manure was used. The data consistently show the value of improved seed through the third generation.

Tables 9 and 10 show comparable data where barnyard manure was used, but no commercial fertilizer. The usual practice was to lay off the rows, sow manure in the row and bed on it with two or four furrows.

Records cover only two generations of seed, second and 'fourth and older', and are not conclusive because of the small numbers of observations in the generation groups and because of the breaks in the series.

It may be noted, however, that the loss per acre was greater for second generation seed than for 'fourth and older' seed. This was, primarily, because of a difference in yield in favor of the older seed.

Of perhaps more interest is a comparison of these data with those of Tables 7 and 8 where neither fertilizer nor manure was used. Average per acre costs were \$3.19 higher where manure was used than where no fertilizer or manure was used, while the yield of lint per acre was greater by .9 of a pound where no fertilizer or manure was used. The data indicate that on these farms for the particular year, manure was worthless although its estimated value and the value of labor to apply it entered into the costs. Manure was valued at an average of \$1.81 per load which was perhaps high when the size of load and quality is considered.

The experience of the thirteen farmers using manure under cotton should not be taken as evidence that manure under cotton is harmful or even worthless. Results obtained on the Experiment Station farm indicate that the consistent application of barnyard manure to cotton land is a profitable practice. The Station results were obtained by broadcast applications of manure rather than by application in rows.

In the opinion of the farmers using manure only, the poor showing was largely because of a pronounced plant development, slowness of fruiting and subsequent weevil damage. In two cases the growers reported that the manured cotton suffered unduly from dry weather. It is probable that barnyard manure finds its best uses under corn and feed crops, and that when it is used under cotton, it should be applied broadcast rather than in the row.

Tables 11 to 20 contain cost and receipts data where commercial fertilizer was used in amounts varying from 1 to over 300 pounds together with small amounts

of barnyard manure. The data consistently show the value of the better seed.

Tables 21 and 22 summarize the data of the preceding tables based on the records sorted according to amount of fertilizer used. It may be remarked that the lowest cost per acre occurred where no fertilizer was used, while the highest cost occurred where barnyard manure only was used. The same order occurred in costs per pound of lint. In loss per acre, those using no fertilizer had the lowest and those using barnyard manure alone had the highest. Yield of lint, Table 22, increased as the size of commercial fertilizer application increased.

The final conclusion may be drawn that the planting of first and second generation cotton seed is justified by the financial returns.

Table 1—Comparative Costs of Production and Values of Cotton Produced From Different Generations of Seed—All Varieties Mississippi—Crop of 1932

Generations—Plantings after purchase of pedigreed seed						
Item	First	Second	Third	Fourth	Fifth and older seed	All seed stocks
Number of records	11	107	33	11	14	176
Av. acres per farm	18.0	14.0	12.6	8.7	13.4	13.6
Av. cost per acre						
Seed	\$.96	\$.43	\$.33	\$.26	\$.43	\$.45
Fertilizer and manure	2.45	1.74	1.28	1.90	1.41	1.70
Gin and wrap	1.82	1.38	.98	1.33	1.25	1.33
Pick	2.55	2.25	1.74	2.12	1.96	2.16
Other labor	6.85	5.81	5.63	5.15	5.93	5.85
Horse work	4.29	3.97	4.00	3.77	3.81	3.98
Machinery use	.95	.88	.89	.84	.84	.88
Mechanical power	.07	.05	.02	.01	.09	.05
Subtotal	\$19.94	\$16.51	\$14.87	\$15.38	\$15.72	\$16.40
Land use	4.88	3.65	2.65	3.27	2.88	3.51
Total	\$24.82	\$20.16	\$17.52	\$18.65	\$18.60	\$19.91
Value per acre						
Lint	\$16.48	\$12.77	\$9.28	\$11.07	\$9.76	\$12.16
Seed	3.06	1.85	1.33	1.99	1.83	1.88
Total	\$19.54	\$14.62	\$10.61	\$13.06	\$11.59	\$14.04
Loss or gain	L\$5.28	L\$5.54	L\$6.91	L\$5.59	L\$7.01	L\$5.87
Prices received						
Lint per lb.—cts	6.50	6.47	6.28	6.28	6.00	6.41
Seed per ton—dol.	14.28	10.45	10.00	12.34	11.95	11.07
Cost lint per lb.—cts.	8.58	9.29	10.95	9.45	10.32	9.50

Table 2—Comparative Quantities and Prices Pertaining to Production of Cotton Grown From Different Generation of Seed—All Varieties—Mississippi—Crop of 1932

Generations—Plantings after purchase of pedigreed seed						
Item	First	Second	Third	Fourth	Fifth and older seed	All seed stocks
Number of records	11	107	33	11	14	176
Average per acre:						
Seed used—bushels	.93	.95	1.1	1.1	1.3	1.0
Fertilizer—pounds	147	134	120	109	83	127
Barnyard manure—loads	1.10	.19	0.00	.32	.07	.21
Man labor, exclusive of picking—hours	68.50	58.12	56.25	51.38	59.27	58.47
Horse work—hours	47.63	44.13	44.48	41.93	42.29	44.25
Truck use—ton miles	.06	.21	.08	.06	.47	.19
Tractor use—hours	.06	.01	.00	.00	.00	.01
Lint produced—pounds	254.0	197.3	147.8	176.3	162.6	189.8
Seed produced—pounds	429.0	353.3	266.3	322.9	306.1	339.5
Averages:						
Lint percentage	37.18	35.83	35.69	35.31	34.69	35.85
Width of row—_inches	37	36	36	37	39	....
Value planting seed per bu.	\$1.03	\$.45	\$.30	\$.24	\$.33	\$.45
Price fertilizer per ton	19.33	20.85	21.42	22.95	31.72	21.43
Value manure per load	.99	1.61	0.00	2.00	1.21	1.38
Price picking per cwt.	.37	.41	.42	.43	.42	.41
Cost gin-wrap per bale	3.58	3.49	3.33	3.78	3.86	3.52
Ratio: hours horse work to man labor—per cent	70	76	79	82	71	76

Table 3. Comparative Costs of Production and Values of Stoneville Cotton Produced From Different Generations of Seed—Mississippi—Crop of 1932.

Item	Generations—Planting After Purchase of Pedigreed Seed			
	First	Second	Third	All seed stocks
Number of records	5	53	16	64
Av. acres per farm	14.4	13.1	15.5	13.7
Av. costs per acre				
Seed	\$.97	\$.40	\$.31	\$.42
Fertilizer and manure	3.99	2.04	1.40	2.02
Gin and wrap	1.95	1.23	.96	1.21
Pick	3.15	2.51	1.77	2.38
Other labor	6.45	5.91	5.61	5.87
Horse work	5.19	4.41	3.97	4.36
Machinery use	1.15	.98	.88	.97
Mechanical power	.15	.01	.00	.01
Sub total	\$23.00	\$17.49	\$14.90	\$17.24
Land use	6.11	3.76	2.65	3.66
Total	\$29.11	\$21.25	\$17.55	\$20.90
Value per acre				
Lint	\$19.70	\$13.00	\$9.23	\$12.55
Seed	4.75	2.04	1.37	2.08
Total	\$24.45	\$15.04	\$10.60	\$14.63
Loss or gain	L\$4.66	L\$6.21	L\$6.95	L\$6.28
Prices received				
Lint per lb.—cts.	6.29	6.26	6.13	6.24
Seed per ton—dol.	17.05	10.41	9.82	11.00
Cost lint per lb.—cts.	7.78	9.25	10.74	9.36

Table 4. Comparative Quantities and Prices Pertaining to Production of Stoneville Cotton Grown From Different Generations of Seed—Mississippi—Crop of 1932.

Item	Generations—Planting After Purchase of Pedigreed Seed			
	First	Second	Third	All seed stocks
Number of records	5	53	16	64
Average per acre:				
Seed used—bushels	1.10	1.00	1.07	1.00
Fertilizer—pounds	126	149	119	140
Barnyard manure—loads	2.89	.35	.00	.45
Man labor exclusive of picking—hours	64.46	59.01	56.09	58.68
Horse work—hours	57.63	48.92	43.72	48.27
Truck use—ton miles	.00	.02	.00	.02
Tractor use—hours	.15	.00	.00	.01
Lint produced—pounds	313.1	207.7	150.6	201.2
Seed produced—pounds	557.6	391.5	278.1	375.6
Averages:				
Lint percentage	35.96	34.66	35.13	34.89
Width of row—_inches	36	36	35	36
Value planting seed per bu.	\$.87	\$.39	\$.29	\$.40
Price fertilizer per ton	18.10	19.05	23.35	19.88
Value manure per load	.99	1.74	0.00	1.39
Price picking per cwt.	.36	.42	.41	.41
Cost gin-wrap per bale	3.12	2.97	3.19	3.03
Ratio: hours horse work to man labor—per cent	89	83	78	82

**Table 5. Comparative Costs of Production and Values of Delta and Pine Land Cotton
Produced From Different Generations of Seed—Mississippi—Crop of 1932**

Item	Generations—Plantings After Purchase of Pedigreed Seed				
	First	Second	Third	Fourth and fifth	All seed stocks
Number of records	5	45	6	6	62
Av. acres per farm	24.6	14.6	8.2	7.7	14.1
Av. costs per acre					
Seed	\$.96	\$.39	\$.55	\$.36	\$.48
Fertilizer and manure	1.62	1.63	1.53	1.90	1.64
Gin and wrap	1.74	1.54	1.31	1.41	1.55
Pick	2.14	2.02	1.97	2.07	2.04
Other labor	7.09	5.58	6.35	5.46	5.83
Horse work	3.79	3.34	4.22	3.68	3.47
Machinery use	.84	.75	.94	.82	.77
Mechanical power	.02	.12	.07	.03	.09
Sub total	\$18.20	\$15.37	\$16.94	\$15.73	\$15.87
Land use	4.16	3.62	3.17	3.31	3.66
Total	\$22.36	\$18.99	\$20.11	\$19.04	\$19.53
Value per acre					
Lint	\$14.54	\$12.85	\$10.95	\$11.45	\$12.91
Seed	2.08	1.65	1.75	1.80	1.72
Total	\$16.82	\$14.50	\$12.70	\$13.25	\$14.63
Loss or gain	L\$5.74	L\$4.49	L\$7.41	L\$5.80	L\$4.90
Prices received					
Lint per lb.—cts	6.71	6.72	6.51	6.67	6.71
Seed per ton—dol.	11.91	10.35	11.84	11.23	10.71
Cost lint per lb.—cts ..	9.35	9.07	10.92	10.05	9.25

**Table 6. Comparative Quantities and Prices Pertaining to Production of Delta and Pine
Land Cotton Grown From Different Generations of Seed—Mississippi—Crop of 1932**

Item	Generations—Plantings After Purchase of Pedigreed Seed				
	First	Second	Third	Fourth and fifth	All seed stocks
Number of records	5	45	6	6	62
Average per acre:					
Seed used—bushels	.74	.83	1.34	1.40	.87
Fertilizer—pounds	163	132	147	119	137
Barnyard manure—loads ..	0	.05	0	.21	.05
Man labor exclusive of picking—hours	70.88	55.78	63.59	54.62	58.28
Horse work—hours	42.06	37.17	46.85	40.95	38.60
Truck use—ton miles	.10	.47	.35	.14	.16
Tractor use—hours	.00	.03	.00	.00	.02
Lint produced—pounds	216.8	191.2	168.1	171.5	192.5
Seed produced—pounds	349.1	318.7	296.4	320.6	321.8
Averages:					
Lint percentage	38.31	37.50	36.19	34.86	37.42
Width of rows—_inches	40	40	39	38	40
Value planting seed per bu.	\$1.30	\$.47	\$.41	\$.25	\$.55
Price of fertilizer per ton	19.89	23.35	20.83	24.73	24.01
Value manure per load	0	.08	0	2.00	1.61
Price picking per cwt.	.38	.40	.42	.42	.40
Cost gin-wrap per bale	4.02	4.03	3.89	4.11	4.02
Ratio: hours horse work to man labor—per cent	59	67	74	75	66

Table 7. Comparative Costs of Production and Values of Cotton Produced From Different Generations of Seed Without Fertilizer or Manure—Mississippi—Crop of 1932

Item	Generations—Plantings After Purchase of Pedigreed Seed				
	First	Second	Third	Fourth and older	All seed stocks
Number of records	3	30	14	7	54
Av. acres per farm	14.33	15.03	11.07	10.86	13.43
Av. costs per acre					
Seed	\$.58	\$.44	\$.26	\$.34	\$.40
Fertilizer					
Gin and wrap	1.59	1.30	.79	.88	1.16
Pick	2.43	2.14	1.43	1.84	1.98
Other labor	5.92	5.95	5.12	4.69	5.64
Horse work	4.16	4.06	3.81	2.91	3.89
Machinery use	.92	.90	.85	.65	.87
Mechanical power		.02	.04		.02
Sub total	\$15.60	\$14.81	\$12.30	\$11.31	\$13.96
Land use	4.26	3.34	2.20	2.30	3.04
Total	\$19.86	\$18.15	\$14.50	\$13.61	\$17.00
Value per acre					
Lint	\$15.15	\$11.56	\$7.70	\$7.82	\$10.55
Seed	1.87	1.80	1.10	1.38	1.61
Total	\$17.02	\$13.36	\$8.80	\$9.20	\$12.16
Loss or gain	L\$2.84	L\$4.79	L\$5.70	L\$4.41	L\$4.84
Prices received					
Lint per lb.—cts.	6.99	6.15	6.28	5.80	6.21
Seed per ton—dol.	10.46	10.71	9.54	12.01	10.60
Cost lint per lb.—cts.	8.30	8.71	10.92	9.07	9.05

Table 8. Comparative Quantities and Prices Pertaining to Production of Cotton Grown From Different Generations of Seed Without Fertilizer or Manure—Mississippi—Crop of 1932

Item	Generations—Plantings After Purchase of Pedigreed Seed				
	First	Second	Third	Fourth and older	All seed stocks
Number of records	3	30	14	7	54
Average per acre:					
Seed used—bushels	.74	.87	1.00	1.25	.93
Fertilizer—pounds					
Barnyard manure—loads					
Man labor, exclusive of picking—hours	59.15	59.49	51.30	46.90	56.40
Horse work—hours	46.25	45.10	42.31	32.39	43.24
Truck use—ton miles		.11	.19		.11
Tractor use—hours					
Lint produced—pounds	216.7	187.8	122.6	134.8	170.0
Seed produced—pounds	357.2	335.7	231.1	229.9	303.5
Averages:					
Lint percentage	37.76	35.87	34.67	36.95	35.90
Width or rows—inches	.42	.37	.36	.38	.37
Value planting seed per bu.	\$.78	\$.50	\$.26	\$.27	\$.43
Price fertilizer per ton					
Value manure per load					
Price of picking per cwt.	.42	.41	.40	.50	.42
Cost gin-wrap per bale	3.66	3.46	2.65	3.27	3.42
Ratio: hours horse work to man labor—per cent	.78	.76	.82	.69	.77

Table 9. Comparative Costs of Production and Values of Cotton Produced From Different Generations of Seed With Manure, But no Fertilizer—Mississippi—Crop of 1932

Item	Generations—Plantings After Purchase of Pedigreed Seed				
	First	Second	Third	Fourth and older	All seed stocks
Number of records	None	10	None	3	13
Av. acres per farm		9.55		9.33	9.50
Av. costs per acre:					
Seed		\$.42		\$.13	\$.35
Manure		2.95		2.50	2.85
Gin and wrap		.95		1.28	1.02
Pick		1.91		2.16	1.97
Other labor		5.60		6.55	5.82
Horse work		4.31		4.12	4.26
Machinery use		.96		.92	.95
Mechanical power					
Sub total		\$17.10		\$17.66	\$17.22
Land use		2.85		3.37	2.97
Total		\$19.95		\$21.03	\$20.19
Value per acre:					
Lint		\$10.00		\$11.48	\$10.33
Seed		1.41		1.98	1.55
Total		\$11.41		\$13.46	\$11.88
Loss or gain		L\$8.54		L\$7.57	L\$8.31
Prices received:					
Lint per lb.—cts.		6.13		6.06	6.11
Seed per ton—dol.		9.46		11.34	9.94
Cost per lb. lint—cts.		11.36		10.06	11.03

Table 10. Comparative Quantities and Prices Pertaining to Production of Cotton Grown From Different Generations of Seed With Manure, but no Fertilizer Mississippi—Crop of 1932

Item	Generations—Plantings After Purchase of Pedigreed Seed				
	First	Second	Third	Fourth and older	All seed stocks
Number of records	None	10	None	3	13
Average per acre:					
Seed used—bushels		.98		.91	.97
Fertilizer—pounds					
Barnyard manure—loads		1.62		1.39	1.57
Man labor, exclusive of picking—hours		56.03		65.53	58.18
Horse work—hours		47.87		45.77	47.40
Truck use—ton miles					
Tractor use—hours					
Lint produced—pounds		163.2		189.3	169.1
Seed produced—pounds		299.8		349.3	311.0
Average:					
Lint percentage		35.25		35.15	35.22
Width of row—inches		36		38	37
Value planting seed per bu.		\$.42		\$.14	\$.36
Price fertilizer per ton					
Value manure per load		1.82		1.79	1.81
Price picking per cwt.		.41		.40	.41
Cost gin-wrap per bale		2.90		3.40	3.01
Ratio: hours horse work to man labor—per cent		85		70	81

Table 11. Comparative Costs of Production and Value of Cotton Produced From Different Generations of Seed With 0 to 100 Pounds of Fertilizer—Mississippi—Crop of 1932

Item	Generations—Plantings After Purchase of Pedigreed Seed			
	First	Second	Third and older	All seed stocks
Number of records	None	11	6	17
Av. acres per farm		17.18	10.41	14.79
Av. costs per acre:				
Seed		\$.34	\$.23	\$.31
Fertilizer and manure		1.37	1.03	1.29
Gin and wrap		1.35	1.35	1.35
Pick		1.14	1.89	2.08
Other labor		6.19	6.21	6.20
Horse work		3.92	3.73	3.87
Machinery use		.87	.83	.86
Mechanical power		.15	.07	.13
Sub total		\$16.33	\$15.34	\$16.09
Land use		3.61	3.07	3.47
Total		\$19.94	\$18.41	\$19.56
Value per acre:				
Lint		\$12.77	\$10.58	\$12.23
Seed		1.64	1.68	1.65
Total		\$14.41	\$12.26	\$13.88
Loss or gain		L\$5.53	L\$6.15	L\$5.68
Prices received				
Lint per lb.—cts.		6.63	6.15	6.52
Seed per ton—dol.		9.67	11.16	10.01
Cost per lb. lint—cts ..		9.50	9.73	9.55

Table 12. Comparative Quantities and Prices Pertaining to Production of Cotton Grown From Different Generations of Seed With 0 to 100 Pounds of Fertilizer Mississippi—Crop of 1932

Item	Generations—Plantings After Purchase of Pedigreed Seed			
	First	Second	Third and older	All seed stocks
Number of records	None	11	6	17
Average per acre:				
Seed used—bushels		.97	.99	.97
Fertilizer—pounds		89	87	88
Barnyard manure—loads ..		.36	....	.27
Man labor, exclusive of picking—hours.....		61.93	62.14	61.98
Horse work—hours		43.57	41.47	43.04
Truck use—ton miles		.29	.35	.31
Tractor use—hours		.09	....	.07
Lint produced—pounds		192.6	172.0	187.5
Seed produced—pounds		339.2	300.7	329.7
Average:				
Lint percentage		36.22	36.39	36.26
Width of rows—_inches ..		37	36	37
Value planting seed per bu.		\$.35	\$.23	\$.32
Price fertilizer per ton		19.53	23.61	20.53
Value manure per load		1.40	....	1.40
Price picking per cwt.		.40	.40	.40
Cost gin-wrap per bale		3.51	3.93	3.60
Ratio: hours horse work to man labor—per cent		70	67	69

Table 13. Comparative Costs of Production and Values of Cotton Produced From Different Generations of Seed With 101 to 150 Pounds of Fertilizer—Crop of 1932

Item	Generations—Plantings After Purchase of Pedigreed Seed			
	First	Second	Third and older	All seed stocks
Number of records	None	16	9	25
Av. acres per farm		11.00	16.78	13.08
Av. costs per acre:				
Seed		\$.40	\$.42	\$.41
Fertilizer and manure		1.88	1.97	1.92
Gin and wrap		1.40	1.15	1.29
Pick		2.22	1.74	2.00
Other labor		5.37	5.57	5.46
Horse work		3.72	3.80	3.75
Machinery use		.83	.84	.83
Mechanical power		.04	.10	.07
Sub total		\$15.86	\$15.59	\$15.73
Land use		3.76	2.72	3.28
Total		\$19.62	\$18.31	\$19.01
Value per acre:				
Lint		\$12.98	\$9.29	\$11.27
Seed		2.05	1.60	1.85
Total		\$15.03	\$10.89	\$13.12
Loss or gain		L\$4.59	L\$7.42	L\$5.89
Prices received:				
Lint per lb.—cts		6.59	6.41	6.52
Seed per ton—dol.		11.54	11.98	11.60
Cost per lb. lint—cts.		8.92	11.52	9.93

Table 14. Comparative Quantities and Prices Pertaining to Production of Cotton Grown From Different Generations of Seed With 101 to 150 Pounds of Fertilizer—Mississippi—Crop of 1932

Item	Generations—Plantings After Purchase of Pedigreed Seed			
	First	Second	Third and older	All seed stocks
Number of records	None	16	9	25
Average per acre:				
Seed used—bushels		.93	1.24	1.07
Fertilizer—pounds		138	131	135
Barnyard manure—loads		.19	.04	.12
Man labor, exclusive of picking—hours		53.80	55.61	54.63
Horse work—hours		41.30	42.17	41.70
Truck use—ton miles		.20	.52	.34
Tractor use—hours				
Lint produced—pounds		197.0	145.0	173.0
Seed produced—pounds		355.8	274.6	318.3
Average:				
Lint percentage		35.63	34.55	35.21
Width of rows—_inches		38	38	38
Value planting seed per bu.		\$.43	\$.34	\$.38
Price fertilizer per ton		23.27	29.11	25.90
Value manure per load		1.43	1.50	1.44
Price picking per cwt.		.40	.41	.41
Cost gin-wrap per bale		3.56	3.97	3.72
Ratio: horse work to man labor—per cent		77	76	76

Table 15. Comparative Costs of Production and Values of Cotton Produced From Different Generations of Seed With 151 to 200 Pounds of Fertilizer—Mississippi—Crop of 1932

Item	Generations—Plantings After Purchase of Pedigreed Seed				
	First	Second	Third	Fourth and older	All seed stocks
Number of records	3	20	7	3	33
Acres per farm	15.33	17.97	15.43	10.33	16.50
Av. costs per acre:					
Seed	\$1.05	\$.88	\$.28	\$.74	\$.44
Fertilizer and manure	5.62	2.10	1.85	2.17	2.35
Gin and wrap	2.39	1.45	1.27	1.70	1.51
Pick	3.62	2.27	2.38	2.93	2.44
Other labor	5.67	5.59	5.64	7.09	5.69
Horse work	4.84	3.72	4.41	5.27	4.04
Machinery use	1.07	.83	.98	1.17	.90
Mechanical power		.06			.04
Sub total	\$24.26	\$16.40	\$16.81	\$21.07	\$17.41
Land use	7.48	3.62	3.35	4.03	3.91
Total	\$31.74	\$20.02	\$20.16	\$25.10	\$21.32
Value per acre:					
Lint	\$24.15	\$12.75	\$11.90	\$13.54	\$13.59
Seed	5.78	1.72	1.51	2.57	2.07
Total	\$29.93	\$14.47	\$13.41	\$16.11	\$15.66
Loss or gain	L\$1.81	L\$5.55	L\$6.75	L\$8.99	L\$5.66
Prices received:					
Lint per lb.—cts.	6.53	6.53	6.27	5.99	6.45
Seed per ton—dol.	17.89	9.87	9.02	11.43	11.74
Cost per lb. lint—cts ..	7.02	9.37	9.83	9.97	9.14

Table 16. Comparative Quantities and Prices Pertaining to Production of Cotton Grown From Different Generations of Seed With 151 to 200 Pounds of Fertilizer Mississippi—Crop of 1932

Item	Generations—Plantings After Purchase of Pedigreed Seed				
	First	Second	Third	Fourth and older	All seed stocks
Number of records	3	20	7	3	33
Average per acre:					
Seed used—bushels	1.04	.84	1.13	1.61	.96
Fertilizer—pounds	187	194	184	200	192
Barnyard manure—loads ..	3.72	.05			.35
Man labor, exclusive of picking—hours ..	56.68	55.93	56.37	70.95	56.94
Horse work—hours	53.77	41.38	49.06	58.50	44.93
Truck use—ton miles		.30			.20
Tractor use—hours					
Lint produced—pounds	369.9	195.2	189.8	225.8	210.6
Seed produced—pounds	646.0	349.0	335.1	450.6	377.1
Average:					
Lint percentage	36.41	35.86	36.15	33.38	35.83
Width of rows—inches	36	38	37	40	38
Value planting seed per bu.	\$1.00	\$.45	\$.25	\$.46	\$.46
Price fertilizer per ton	20.31	19.61	20.01	21.73	19.88
Value manure per load	1.00	3.50			1.26
Price picking per cwt.	.56	.42	.45	.43	.42
Cost gin-wrap per bale	3.21	3.71	3.34	3.76	3.57
Ratio: hours horse work to man labor—per cent	95	74	87	82	79

Table 17. Comparative Costs of Production and Values of Cotton Produced From Different Generations of Seed With 201 to 300 Pounds of Fertilizer—Mississippi—Crop of 1932

Generations—Plantings After Purchase of Pedigreed Seed				
Item	First	Second	Third	All seed stocks
Number of records	None	12	7	19
Acres per farm		10.17	11.14	10.53
Av. costs per acre:				
Seed		\$.49	\$.45	\$.48
Fertilizer and manure		2.87	2.99	2.92
Gin and wrap		1.70	1.18	1.50
Pick		2.74	1.85	2.39
Other labor		5.82	6.37	6.03
Horse work		4.23	4.26	4.24
Machinery use		.94	.95	.94
Mechanical power			.01	.01
Sub total		\$18.79	\$18.07	\$18.51
Land use		4.74	3.02	4.07
Total		\$23.53	\$21.09	\$22.58
Value per acre:				
Lint		\$16.43	\$10.32	\$14.05
Seed		2.54	1.74	2.22
Total		\$18.97	\$12.06	\$16.27
Loss or gain		L\$4.56	L\$9.03	L\$6.31
Prices received:				
Lint per lb.—cts		6.63	6.16	6.49
Seed per ton—dol.		11.71	11.32	11.59
Cost per lb. lint—cts.		8.48	11.54	9.40

Table 18. Comparative Quantities and Prices Pertaining to Production of Cotton Grown From Different Generations of Seed With 201 to 300 Pounds of Fertilizer Mississippi—Crop of 1932

Generations—Plantings After Purchase of Pedigreed Seed				
Item	First	Second	Third	All seed stocks
Number of records	None	12	7	19
Average per acre:				
Seed used—bushels		1.11	1.15	1.13
Fertilizer—pounds		266	264	265
Barnyard manure—loads		.07		.04
Man labor, exclusive of picking—hours		58.20	63.79	60.38
Horse work—hours		47.04	47.40	47.18
Truck use—ton miles			.07	.03
Tractor use—hours				
Lint produced—pound		247.7	167.7	216.5
Seed produced—pound		433.4	307.6	384.3
Average:				
Lint percentage		36.37	35.28	36.03
Width of rows—_inches		40	36	39
Value planting seed per bu.		\$.44	\$.39	\$.42
Price fertilizer per ton		21.30	22.67	20.83
Value manure per load		.60		.60
Price picking per cwt.		.40	.39	.40
Cost gin-wrap per bale		3.44	3.52	3.46
Ratio: hours horse work to man labor—per cent		81	74	78

Table 19. Comparative Costs of Production and Values of Cotton Produced From Different Generations of Seed With Over 300 Pounds of Fertilizer—Mississippi—Crop of 1932

Item	Generations—Plantings After Purchase of Pedigreed Seed		
	First	Second	All seed stocks
Number of records	2	8	10
Acres per farm	9.50	13.16	12.42
Av. costs per acre:			
Seed	\$.82	\$.70	\$.72
Fertilizer and manure	3.37	5.91	5.52
Gin and wrap	2.25	1.37	1.50
Pick	2.87	2.58	2.62
Other labor	4.96	6.02	5.86
Horse work	3.22	4.23	4.08
Machinery use	.71	.94	.91
Mechanical power	.13	.13	.13
Sub total	\$18.33	\$21.88	\$21.34
Land use	5.68	4.39	4.59
Total	\$24.01	\$26.27	\$25.93
Value per acre:			
Lint	\$20.14	\$15.53	\$16.24
Seed	2.57	2.03	2.12
Total	\$22.73	\$17.56	\$18.36
Loss or gain	L\$1.28	L\$8.71	L\$7.57
Prices received:			
Lint per lb.—cts.	6.83	7.04	7.00
Seed per ton—dol.	10.98	9.89	10.08
Cost per lb. lint—cts.	7.26	10.98	10.26

Table 20. Comparative Quantities and Prices Pertaining to Production, of Cotton Grown From Different Generations of Seed With Over 300 Pound of Fertilizer Mississippi—Crop of 1932

Item	Generations—Plantings After Purchase of Pedigreed Seed		
	First	Second	All seed stocks
Number of records	2	8	10
Average per acre:			
Seed used—bushels	1.00	1.43	1.36
Fertilizer—pounds	342	535	506
Barnyard manure—loads	.37	.17	.20
Man labor, exclusive of picking—hours	49.65	60.17	58.56
Horse work—hours	35.74	47.05	45.32
Truck use—ton miles	.63	.69	.67
Tractor use—hours			
Lint produced—pounds	294.9	220.7	232.1
Seed produced—pounds	472.2	411.0	420.4
Average:			
Lint percentage	38.45	34.94	35.57
Width of rows—_inches	36	36	36
Value planting seed per bu.	\$.82	\$.49	\$.52
Price fertilizer per ton	17.54	21.45	21.05
Value manure per load	1.00	1.00	1.00
Price picking per cwt.	.37	.41	.40
Cost gin-wrap per bale	3.82	3.10	3.24
Ratio: hours horse work to man hours—per cent	72	78	77

Table 21. Comparative Costs of Production and Values of Cotton Production With Varying Applications of Fertilizer—All Seed Stocks—Mississippi—Crop of 1932

Item	Fertilizer Applied per Acre						
	None	Barnyard manure only	Commercial Fertilizer Applications With Varying Amounts of Barnyard Manure				
			0-100	101-150	150-200	201-300	Over 300
Number of records	54	13	17	25	33	19	10
Acres per farm	13.43	9.50	14.79	13.08	16.50	10.53	12.42
Av. costs per acre:							
Seed	\$.40	\$.35	\$.31	\$.41	\$.44	\$.48	\$.72
Fertilizer and manure		2.85	1.29	1.92	2.35	2.92	5.52
Gin and wrap	1.16	1.02	1.35	1.29	1.50	1.50	1.50
Pick	1.98	1.97	2.08	2.00	2.44	2.39	2.62
Other labor	5.64	5.82	6.20	5.46	5.69	6.03	5.86
Horse work	3.89	4.26	3.87	3.75	4.04	4.24	4.08
Machinery use	.87	.95	.86	.83	.90	.94	.91
Mechanical power	.02		.13	.07	.04	.01	.13
Sub total	\$13.96	\$17.22	\$16.09	\$15.73	\$17.41	\$18.51	\$21.34
Land use	3.04	2.97	3.47	3.28	3.91	4.07	4.59
Total	\$17.00	\$20.19	\$19.56	\$19.01	\$21.32	\$22.58	\$25.93
Value per acre:							
Lint	\$10.55	\$10.33	\$12.23	\$11.27	\$13.59	\$14.05	\$16.24
Seed	1.61	1.55	1.65	1.85	2.07	2.22	2.12
Total	\$12.16	\$11.88	\$13.88	\$13.12	\$15.66	\$16.27	\$18.36
Loss	\$4.84	\$8.31	\$5.68	\$5.89	\$5.66	\$6.31	\$7.57
Prices received:							
Lint per lb.—cts.	6.21	6.11	6.52	6.52	6.45	6.49	7.00
Seed per ton—dol.	10.60	9.94	10.01	11.60	11.74	11.59	10.68
Cost lint per lb.—cts.	9.05	11.03	9.55	9.93	9.14	9.40	10.26

Table 22. Comparative Quantities and Prices Pertaining to Production of Cotton With Varying Applications of Fertilizer—All Seed Stocks—Mississippi—Crop of 1932

Item	Fertilizer Applied per Acre						
	None	Barnyard manure only	Commercial Fertilizer Applications With Varying Amounts of Barnyard Manure				
			0-100	101-150	151-200	201-300	Over 300
Number of records	54	13	17	25	33	19	10
Average per acre:							
Seed used—bushels	.93	.97	.97	1.07	.96	1.13	1.30
Fertilizer—pounds			88	135	192	265	506
Barnyard manure—loads		1.57	.27	.12	.35	.04	.20
Man labor, exclusive of							
picking—hours	56.40	58.18	61.98	54.63	56.94	60.38	58.5
Horse work—hours	43.24	47.40	43.04	41.70	44.93	47.18	45.3
Truck use—ton miles	.11		.31	.34	.20	.03	.6
Tractor use—hours			.07				
Lint produced—pounds	170.0	169.1	187.5	173.0	210.6	216.5	232.1
Seed produced—pounds	303.5	311.0	329.7	318.3	377.1	384.3	420.4
Averages:							
Lint percentage	35.90	35.22	36.26	35.21	35.83	36.03	35.5
Width of rows—_inches	37	37	37	38	38	39	36
Value planting seed per bu.	\$.43	\$.36	\$.32	\$.38	\$.46	\$.42	\$.5
Price fertilizer per ton			20.53	25.90	19.88	20.83	21.0
Value manure per load		1.81	1.40	1.44	1.26	.60	1.0
Price picking per cwt.	.42	.41	.40	.41	.42	.40	.4
Cost gin-wrap per bale	3.42	3.01	3.60	3.72	3.57	3.46	3.2
Ratio: hours horse work to man labor—per cent	77	81	69	76	79	78	77

VARIETIES OF PEACHES

For The

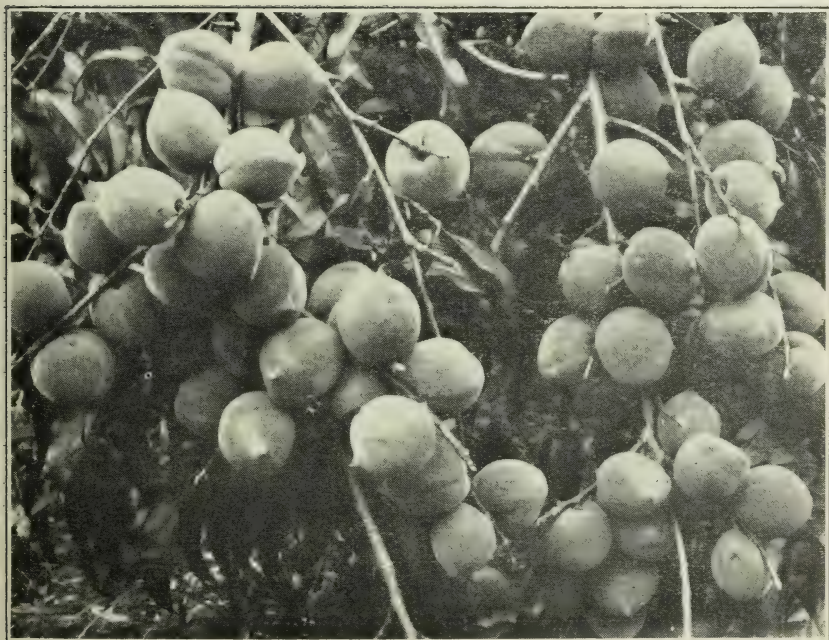
YAZOO-MISSISSIPPI DELTA

Delta Experiment Station

Stoneville, Mississippi

By

E. A. Currey



Section of an Elberta tree showing size, quality, and production of Yazoo-Mississippi Delta peaches. This tree produced 14 bushels in 1928.

MISSISSIPPI AGRICULTURAL EXPERIMENT STATIONS

State College, Mississippi

J. R. RICKS, Director

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VARIETIES OF PEACHES

for the Yazoo-Mississippi Delta

By E. A. Currey*

INTRODUCTION

Peaches are well adapted to Delta conditions. All Delta planters should have at least a home orchard consisting of high yielding, high quality varieties giving a continuous supply of luscious fruit from June 1 until August 15. This bulletin gives the results obtained from 16 varieties of peaches planted in the spring of 1923. Success or failure is often determined by the varieties used.

EXPERIMENTAL METHODS

The trees were planted 20 ft. by 20 ft. (This is entirely too CLOSE. The minimum distance for peaches in the Yazoo-Mississippi Delta is 25 ft. by 30 ft.) All varieties received the same treatment throughout. Records were made of time of ripening, yield, and size of fruit. The trees were numbered by a copper tag tied to each. Every time the fruit was gathered each crate was tagged and the number of the tree kept with the fruit until it was weighed, counted, and recorded. The records show the date of each picking, the number, and weight of the fruit gathered. The average date of the heaviest annual picking is considered the "average ripening date." The ripening period is the period between the average date of the first and last pickings. The records also show total weight of the fruit and total number of fruit. From this the total yield in bushels and the average size of the fruit were calculated.

VARIETY NOTES AND RESULTS

Mayflower, Red Bird Cling, and Early Rose varieties were killed by the 1927 flood. No five-year average on these is available, but they are considered good.

MAYFLOWER

Mayflower ripens about May 24.

It is a vigorous grower and is well adapted to the Delta, but did not stand the flood water as long as the other varieties.

The fruit averages about six to the pound, has a fine, showy color but lacks the good flavor wanted in a peach.

It merely supplies the desire for very early fruit, and, for this reason, sells well.

It is semi-clingstone in type.

VAINQUER

Vainquer was obtained from the Division of Plant Exploration and Introduction of the United States Department of Agriculture.

It has been turned over to three nurseries for propagation.

It ripens about June 1, is a very vigorous grower and heavy yielder.

The fruit averages about five to the pound, is semi-freestone, has a fine showy color, and a good flavor.

The meat is white with a slight reddish tint.

It has not been in the test for five years, but available data show it to be out-standing for home and commercial use.

RED BIRD CLING

Red Bird Cling ripens about June 6, is a clingstone peach, tough, not very juicy, and is not a very heavy yielder. It has a place in the home orchard but upon present data cannot be recommended as a commercial peach.

***Acknowledgements:** The author wishes to express his appreciation to Mr. W. E. Ayres, Assistant Director in Charge of this Station, for constructive criticisms and helpful suggestions at all times; to Mr. J. C. C. Price, formerly of the Central Station who, with Mr. Lyle Brown, formerly of the Extension Service, planned the orchard; to the latter for the early pruning and spraying; and to Mr. D. W. Grimes, now of the State Plant Board, who did the Delta Station horticultural work in 1926 and 1927.

EARLY ROSE

Early Rose ripens about June 14, is a good peach for the home and market orchards, tight clingstone type with an excellent peach flavor.

No five-year records are available on this variety, but it is a surpassingly good early variety.

EARLY ELBERTA

Early Elberta is in the new variety test and ripens about 10 days before regular Elberta.

It is a heavier yielder than Elberta, and its quality is slightly better.

It is recommended to replace Elberta.

Early Elberta must not be confused with the June Elberta which is not recommended.

CHINESE CLING

Chinese Cling ripens about five days before Elberta.

The fruit is white, clingstone, and averages about three to the pound.

It is very fine for pickling and can be recommended for home orchard or market.

It is not in the old variety test but is in the new test and has not been in production for five years.



General view of the variety orchard the third growing season.

TABLE 1.—Peach Production Table—Varieties Listed in Order of Yield

Variety	Average Bushels Per Tree (1)						Average Date Ripe
	1926	1927	1928	1929	1930	Avg.	
Hiley	2.14	3.86	5.02	8.28	7.31	5.32	July 12
Mamie Ross	2.11	3.39	5.40	9.69	4.37	5.00	July 13
Belle of Georgia	1.22	4.01	3.77	7.88	7.63	4.91	July 24
Captain Ede	1.75	3.19	5.57	7.43	6.00	4.79	July 26
Carman	1.85	3.37	4.81	8.20	5.45	4.73	July 7
Engle Mammoth	1.77	3.05	5.00	7.52	6.01	4.67	July 30
Elberta	1.23	2.30	3.80	7.16	3.86	3.67	July 24
Krummelt's Late	—	1.47	1.67	6.27	6.86	3.25	Sept. 9
Greensboro	0.45	2.52	1.58	5.73	5.40	3.13	June 16
Arp Beauty	1.42	0.66	3.46	4.98	3.21	2.75	June 19
Late Crawford	1.46	1.73	4.49	4.18	1.75	2.72	Aug. 4
Lucy Bunn	0.45	1.03	5.10	5.65	0.69	2.58	July 29
October Elberta	0.28	1.46	0.75	4.74	2.30	1.90	Aug. 8
J. H. Hale	1.79	0.49	1.44	4.29	0.56	1.71	July 26
Salway	0.76	1.61	1.83	3.52	0.57	1.67	Aug. 1
June Elberta	1.31	0.46	2.12	3.23	0.53	1.53	June 11

Note: (1) 50 lbs. per bushel is legal. A measured bushel varies from 42 to 50 pounds depending upon size.

TWO very OUTSTANDING NECTARINES obtained from the Federal Division of Plant Importation have been observed. Both were imported from New Zealand and ripen about July 23. One is a heavy producing freestone with excellent flavor. The other is a clingstone with good quality and large size. Both nectarines are soon to be let to nurseries for propagation. They are recommended for home orchards and local markets.

TABLE 2—Peach Size Table—Varieties Listed in Order of Size

Variety	Average Number of Peaches Per Bushel						Avg. No. Per Lb.
	1926	1927	1928	1929	1930	Avg.	
Lucy Bunn	141	139	189	153	120	154	3.08
Elberta	148	156	135	188	155	159	3.18
June Elberta	233	185	210	218	130	168	3.36
Salway	173	172	151	203	150	168	3.36
October Elberta	118	156	145	230	110	171	3.42
J. H. Hale	210	125	149	246	180	194	3.88
Captain Ede	188	208	204	242	225	223	4.46
Late Crawford	203	208	270	243	185	232	4.64
Belle of Georgia	168	192	184	270	270	241	4.82
Krummel's Late		217	299	238	190	242	4.84
Carman	244	217	226	290	215	243	4.86
Mamie Ross	232	200	185	213	375	250	5.00
Engle Mammoth	202	238	265	277	265	269	5.38
Greensboro	193	294	240	251	325	272	5.44
Hiley	242	217	227	289	335	274	5.48
Arp Beauty	262	227	312	352	295	319	6.38

JUNE ELBERTA

Average Ripening Period: June 6 to 15.

Average Date of Heaviest Picking: June 11.

Tree Characteristics: Very hardy wood; buds not so hardy; very vigorous, upright grower.

Productiveness: Very poor, only 1.53 bushels, annually, per tree.

Fruit Characteristics: Large, average 3.36 peaches per pound; freestone; clear orange-yellow color, very attractive; good flavor, tender, and juicy.

Uses: Used for home or market orchards, especially good for early market.

Remarks: Not recommended because of very low production.

GREENSBORO

Average Ripening Period: June 11 to 23.

Average Date of Heaviest Picking: June 16.

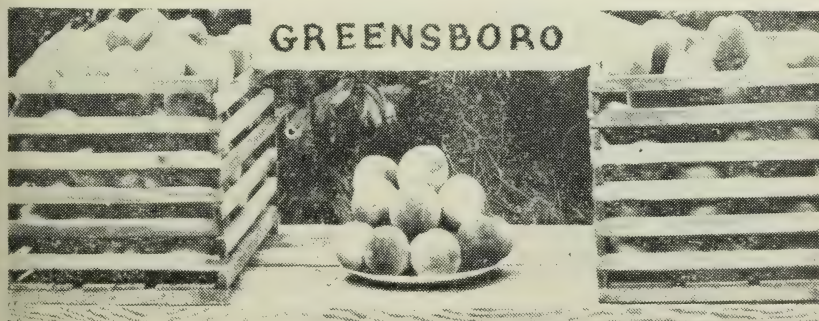
Tree Characteristics: Very hardy bud and wood; vigorous, spreading type.

Productiveness: Averaged 3.13 bushels, annually, per tree.

Fruit Characteristics: Averaged 5.44 peaches per pound; flesh is creamy-white with a deep blush on cheek; semi-clingstone type; ripens at apex before it ripens at stem; undesirable to handle because of bruising the unevenly ripened fruit; tender, juicy, fair flavor.

Uses: Used mostly for eating fresh.

Remarks: Fair for home orchards but not recommended for market.



ARP BEAUTY

Average Ripening Period: June 8 to 23.

Average Date of Heaviest picking: June 16.

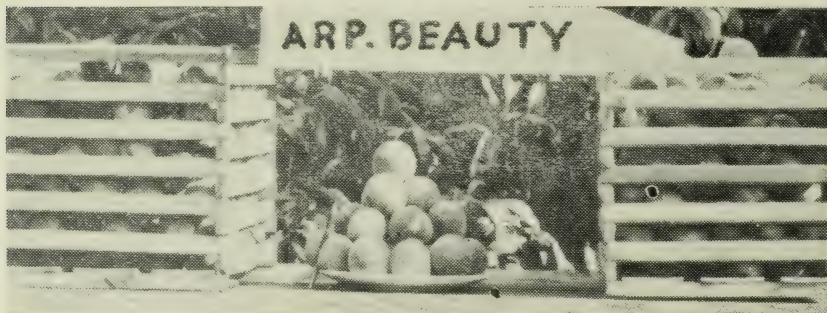
Tree Characteristics: Wood not very hardy; bud hardy; medium vigor, upright type.

Productiveness: Averaged 2.75 bushels, annually, per tree.

Fruit Characteristics: Averaged 6.38 peaches per pound; yellow flesh with deep blush on sunny side; almost round in shape; semi-cling; good quality with good flavor; skin medium thin and tough.

Uses: Its use is general; pickling, eating, and shipping.

Remarks: Recommended for market and home orchards.

**CARMAN**

Average Ripening Period: June 24 to July 11.

Average Date of Heaviest Picking: July 7.

Tree Characteristics: Very hardy buds and wood; withstands cold and dry weather extremely well; very vigorous, upright grower.

Productiveness: Very productive, averaged 4.73 bushels per tree, annually.

Fruit Characteristics: Medium to large, averaged 4.86 peaches per pound; very attractive, white flesh tinted with red; semi-clingstone type; juicy, very fine flavor, firm flesh.

Uses: Used either for home or market, especially good for eating fresh or pickling.

Remarks: This variety ranked fifth in production and is highly recommended for every Delta orchard.

MAMIE ROSS

Average Ripening Period: June 28 to July 13.

Average Date of Heaviest Picking: July 9.

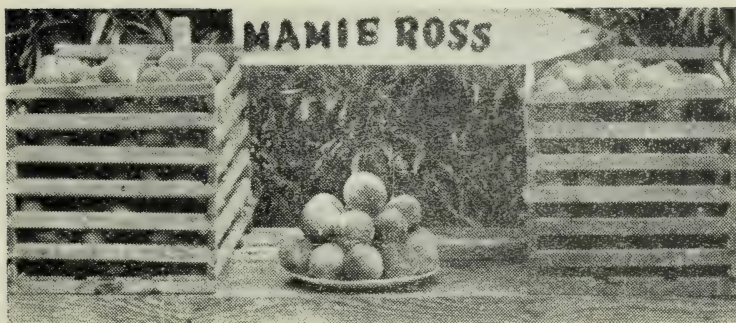
Tree Characteristics: Not as hardy as Carman, does not withstand extremely dry weather well; fruit buds are hardy; medium vigorous, spreading type.

Productiveness: Very productive, dependable bearer, averaged 5.00 bushels, annually, per tree.

Fruit Characteristics: Medium to large, 5.00 peaches to one pound; semi-cling type; white flesh, attractive, showy, deep blush on sunny side; fine quality with good flavor and firm flesh.

Uses: Used for either home or market, especially good for eating fresh.

Remarks: Mamie Ross ranked second in production. In 1929 two trees of this variety averaged more than 10 bushels per tree which led all other varieties. It does not withstand extreme and prolonged droughts as well as Hiley, Carman, Belle of Georgia, or Captain Ede. Since it ripens with Carman and Hiley, which are more desirable for home and market, it is not recommended.



HILEY

Average Ripening Period: July 5 to 19.

Average Date of Heaviest Picking: July 12.

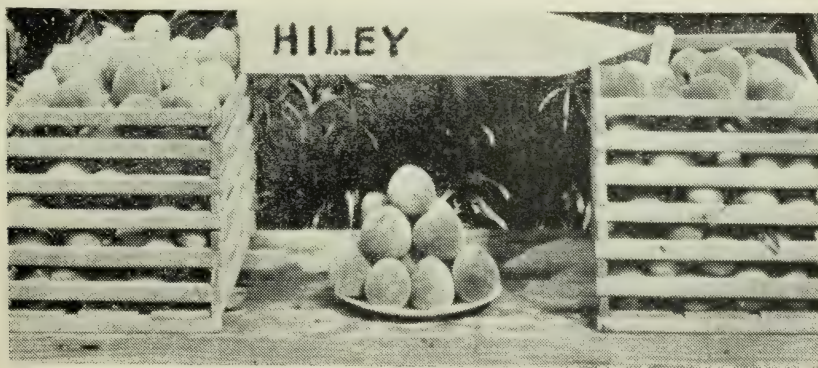
Tree Characteristics: Wood is hardy; bud is hardy. A sufficient number of fruit buds have always come through the winter to insure a heavy crop. The trees are very vigorous and distinctly spreading.

Productiveness: Very productive, dependable bearer, averaged 5.32 bushels per tree. This is the highest producer in the test. One individual tree averaged over 10 bushels of fruit in 1928 and 1929. The five trees averaged 9.2 and 8.1 bushels, respectively, those two years.

Fruit Characteristics: Freestone; white flesh tinted red next to seed; skin is tough, thin, greenish yellow with a dull red blush on the sunny side; averaged 5.48 peaches per pound; flesh firm and tender with very excellent flavor.

Uses: Used for home and market, especially good for eating while fresh, preserving, and canning.

Remarks: Very highly recommended for home and market.

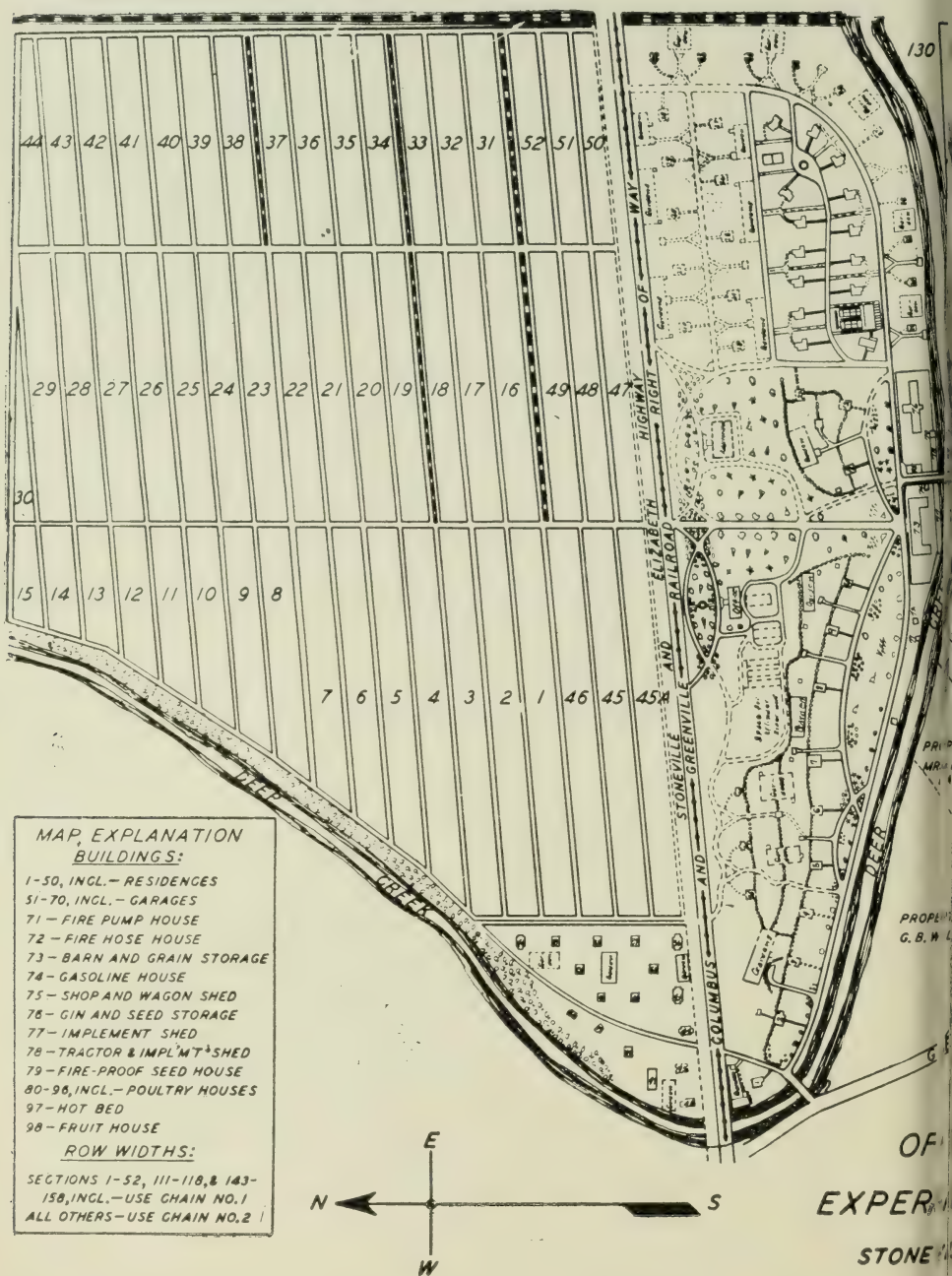


BELLE OF GEORGIA

Average Ripening Period: July 18 to August 1.

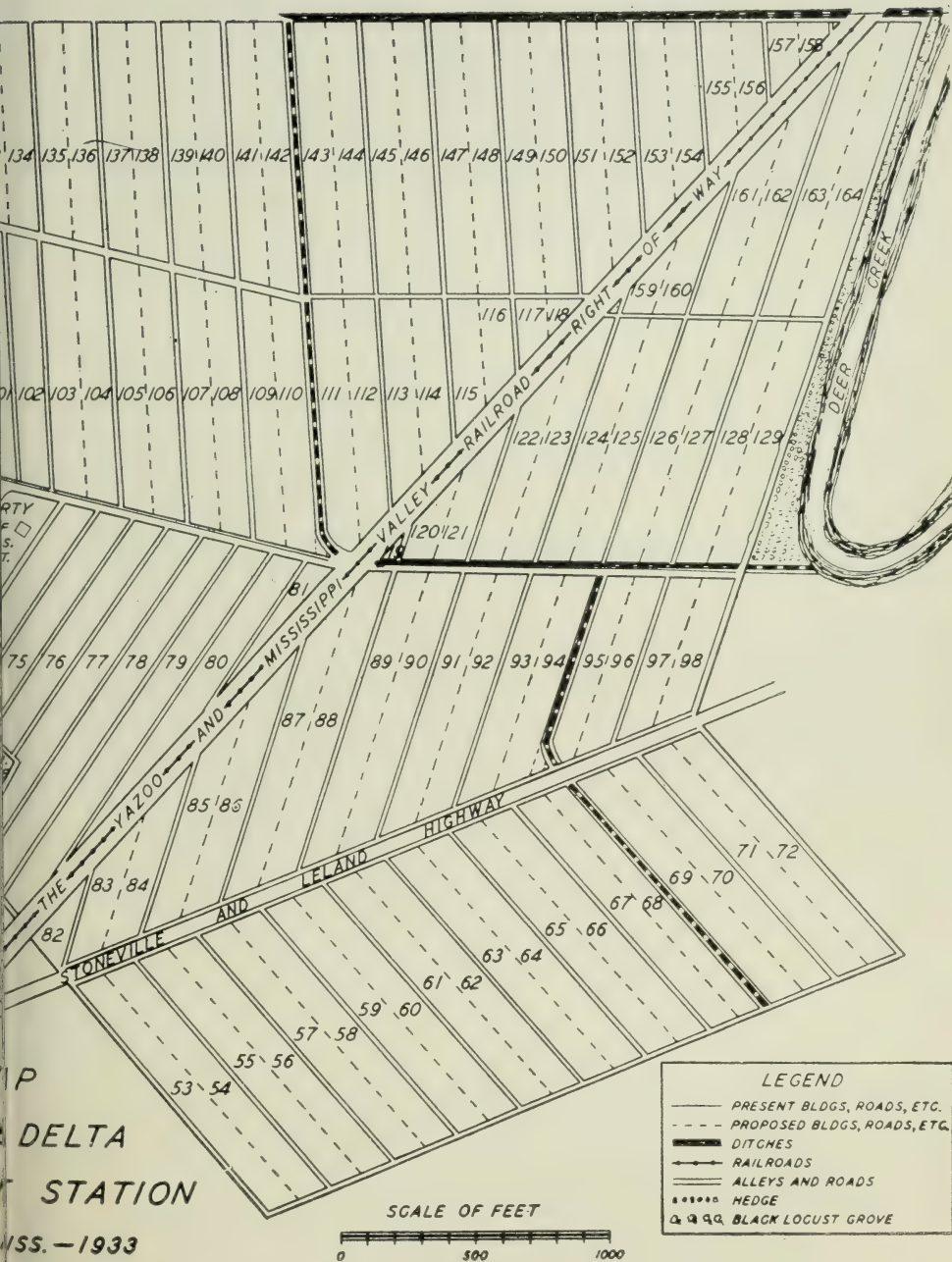
Average Date of Heaviest Picking: July 24.

Tree Characteristics: Large, vigorous, medium spreading, open type, and



DELTA PEACH VARIETIES

9





hardy: fruit buds are not extremely hardy but withstand even the coldest Delta winters.

Productiveness: Very productive, dependable bearer; averaged 4.91 bushels per tree.

Fruit Characteristics: Freestone type; has white flesh, deep colored cheek, skin is thin and tender; averaged 4.82 peaches per pound; flesh is juicy, tender, stringy, and sweet.

Uses: Extra fine for eating while fresh; easily bruised—not good for shipping.

Remarks: This is the outstanding variety of the test for eating from the tree or while fresh. It ranks third in average production. It is very highly recommended for every Delta home orchard, but cannot be recommended for shipping.

CAPTAIN EDE

Average Ripening Period: July 18 to 31.

Average Date of Heaviest Picking: July 26.

Tree Characteristics: Medium to large; vigorous, upright growth; wood and fruit buds hardy.

Productiveness: Very productive, dependable bearer, averaged 4.79 bushels per tree.

Fruit Characteristics: Freestone type; has yellow, firm flesh; skin is thin and tough; averaged 4.46 peaches per pound; fine quality with smooth flesh of good flavor.

Uses: Used for home or market, especially good for eating while fresh and for canning.

Remarks: This variety averaged fourth in production and is fair for market use just before Elberta ripens. It ripens with Belle of Georgia and is not recommended for home orchards, because Belle is superior in quality and production.

J. H. HALE

Average Ripening Period: July 19 to 30.

Average Date of Heaviest Picking: July 26.

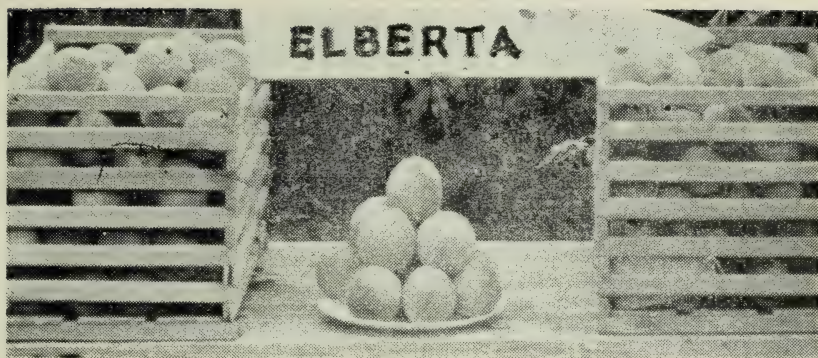
Tree Characteristics: Not very vigorous; spreading habit of growth; wood and fruit buds not hardy.

Productiveness: Very poor, averaged only 1.71 bushels, per tree, annually.

Fruit Characteristics: Very large, averaged 3.88 peaches per pound; nearly spherical in shape; skin thick, tough, pale yellow, covered with mottlings and splashes of attractive red; flesh yellow; freestone type; good quality, flesh juicy, fine grained, sweet.

Uses: Used for shipping and home consumption, especially good for canning.

Remarks: This variety is self-sterile and is more susceptible to brown rot than Elberta. It is not recommended for the home orchard or market.



ELBERTA

Average Ripening Period: July 18 to 31.

Average Date of Heaviest Picking: July 27.

Tree Characteristics: Large, vigorous, upright growth; wood hardy; fruit buds tender, sometimes killed by severe freezes.

Productiveness: Ranks seventh or 3.67 bushels per tree, annually; only medium productive.

Fruit Characteristics: Freestone type; extra large and showy; yellow flesh; skin medium thick and rough; averaged 3.18 peaches per pound; quality only fair, flesh firm, a little stringy, coarse, yet tender and juicy, mild in flavor.

Uses: Used principally for shipping and canning.

Remarks: This variety is the outstanding canning variety and the best selling peach in the test. It is the most popular peach grown and is recommended for both home and market orchards.

LUCY BUNN

Average Ripening Period: July 21 to August 4.

Average date of Heaviest Picking: July 29.

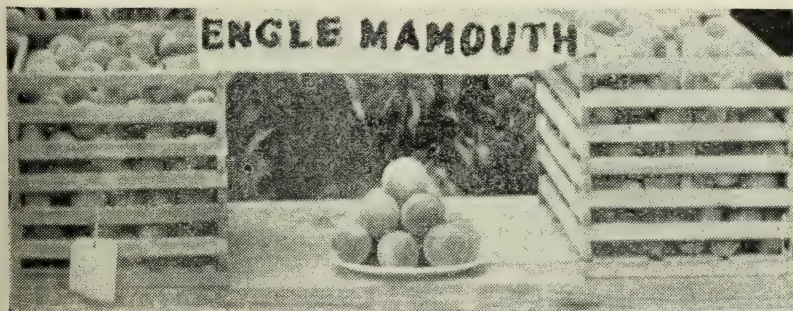
Tree Characteristics: Not very vigorous, upright grower; wood and fruit buds are not hardy.

Productiveness: Very poor, only averaged 2.58 bushels per tree.

Fruit Characteristics: Freestone type, seed usually splits with peach; very large, averaged 3.08 peaches per pound; white flesh; very pubescent, with green skin which turns white when ripe; good quality, flesh juicy, sweet, firm, and tender.

Uses: Used for eating while fresh.

Remarks: Very susceptible to brown rot; fruit often cracks to the seed. Not recommended.



ENGLE MAMMOTH

Average Ripening Period: July 19 to August 1.

Average Date of Heaviest Picking: July 30.

Tree Characteristics: Vigorous, upright grower; wood and fruit buds are hardy.

Productiveness: Productive, averaged 4.67 bushels per tree, annually.

Fruit Characteristics: Freestone type; medium in size, averaged 5.38 peaches per pound; yellow flesh, attractively colored with dark red; good quality, flesh juicy, tender, and of good flavor.

Uses: Used for eating while fresh, canning, or shipping.

Remarks: This variety is good for the home orchard but is not a good market peach because it ripens with the Elberta which is a much better seller. It has a tough skin and will stand shipping well.

SALWAY

Average Ripening Period: July 24 to August 5.

Average Date of Heaviest Picking: August 1.

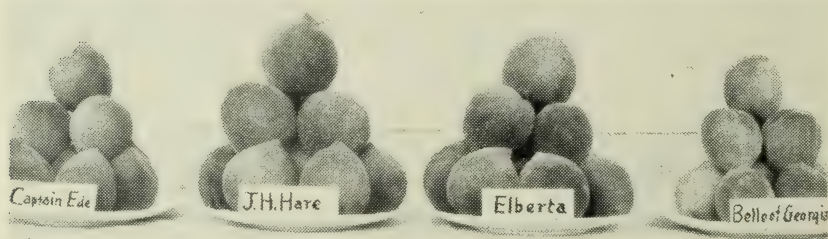
Tree Characteristics: Medium size; not very hardy; upright habit.

Productiveness: Very poor, averaged only 1.67 bushels per tree per year.

Fruit Characteristics: Very large, averaged 3.36 peaches per pound; yellow flesh; thin, tough, greenish-yellow skin; somewhat bulged near the apex, and with unequal halves; excellent quality.

Uses: Used for shipping and canning.

Remarks: Susceptible to brown rot; poor producer, not recommended.



Twelve representative fruits of each of four varieties. (The second variety from the left is J. H. Hare).

LATE CRAWFORD

Average Ripening Period: July 16 to August 8.

Average Date of Heaviest Picking: August 4.

Tree Characteristics: Medium vigorous, upright type. Fruit buds not very hardy.

Productiveness: Poor, averaged only 2.72 bushels per tree, annually.

Fruit Characteristics: Freestone type; yellow; fairly large; averaged 4.64 peaches per pound; quality good, but not outstanding.

Uses: Used for eating while fresh or canning.

Remarks: Not recommended.

OCTOBER ELBERTA

Average Ripening Period: August 5 to 15.

Average Date of Heaviest Picking: August 8.

Tree Characteristics: Medium vigorous, upright grower; fruit buds not very hardy.

Productiveness: Poor producer, averaged only 1.90 bushels per tree.

Fruit Characteristics: Very large, averaged 3.42 peaches per pound; yellow flesh; other characteristics similar to Elberta.

Uses: Same as Elberta.

Remarks: Much more susceptible to brown rot than Elberta; not recommended.

KRUMMEL'S LATE

Average Ripening Period: August 29 to September 10.

Average Date of Heaviest Picking: September 9.

Tree Characteristics: Very vigorous; very upright type; buds and wood hardy.

Productiveness: Best producing late peach in the test; averaged over 7 bushels per tree in 1929 and 1930, but five-year average was 3.25 bushels per tree. It is late coming into bearing but when full grown is a heavy producer.

Fruit Characteristics: Large, 4.84 peaches per pound; spherical in shape; lemon yellow, very faintly blushed with carmine; freestone type; deep yellow flesh, fine in texture, juicy, and good quality.

Uses: Especially good for local market, eating fresh, pickling, and canning.

Remarks: Very susceptible to brown rot. The best late peach in the test. If brown rot is controlled, it is a very profitable variety.

SUMMARY

1. The five highest producing varieties averaged as follows in bushels per tree: Hiley, 5.32; Mamie Ross, 5.00; Belle of Georgia, 4.91; Captain Ede, 4.79; Carman, 4.73.

2. The second five averaged as follows: Engle Mammoth, 4.67; Elberta, 3.67; Krummel's Late, 3.25; Greensboro, 3.13; Arp Beauty, 2.75.

3. The six lowest producers averaged as follows: Late Crawford, 2.72; Lucy Bunn, 2.58; October Elberta, 1.90; J. H. Hale, 1.71; Salway, 1.67; and June Elberta, 1.53 bushels per tree, annually, for 5 years

4. The five varieties having the largest average fruit were: Lucy Bunn, 154 peaches per bushel or 3.08 per pound; Elberta, 159 per bushel or 3.18 per pound; June Elberta, 168 per bushel or 3.36 per pound; Salway, 168 per bushel or 3.36 per pound; October Elberta, 171 per bushel or 3.42 per pound.

5. The second five averaged as follows: J. H. Hale, 194 per bushel or 3.88 per pound; Captain Ede, 223 per bushel or 4.46 per pound; Late Crawford, 232 per bushel or 4.64 per pound; Belle of Georgia, 241 per bushel or 4.82 per pound; and Krummel's Late, 242 peaches per bushel or 4.84 per pound.

6. The six varieties having the smallest average fruit follow: Carman, 243 peaches per bushel or 4.86 per pound; Mamie Ross, 250 per bushel or 5.00 per pound; Engle Mammoth, 269 per bushel or 5.38 per pound; Greensboro, 272 per bushel or 5.44 per pound; Hiley, 274 per bushel or 5.48 per pound; and Arp Beauty, 319 per bushel or 6.38 per pound as an average of five years.

7. The quality of each variety is described on pages three to thirteen under "Variety Notes."

RECOMMENDATIONS

For Delta home orchards or local markets the following varieties are recommended in ripening order: 1, Mayflower; 2, Vainquer; 3, Red Bird Cling; 4, Carman; 5, Hiley; 6, Belle of Georgia; 7, Early Elberta; 8, Elberta; 9, Chinese Cling; 10, Krummel's Late.

For commercial orchards the following varieties are recommended: 1, Carman; 2, Hiley; 3, Early Elberta (not June Elberta); 4, Elberta.

APPENDIX

No section can produce more or better peaches than the Yazoo-Mississippi Delta. The above notes and data set forth satisfactory and desirable varieties. From well-cared-for orchards some peaches may be expected the third growing season, a fair crop the fourth year, and bountiful crops thereafter.

[illegible]

A COMPILATION OF
EXPERIMENTAL DATA
ON

COTTON FERTILIZERS

Applicable To The Hill Sections
Of Mississippi

Compiled By
C. F. CLARK
Coordinator Research Information

Jointly Representing
MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
And
MISSISSIPPI STATE VOCATIONAL BOARD

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INTRODUCTION

It will be noted that the soil series is given for each experiment included in the bulletin. Wherever possible the soil type has been indicated as well as the series. Heretofore a great need has been felt for a knowledge of the soil types from which the various cotton fertilizer experiments have been run. We feel that this will be a step toward adjusting the proper fertilizer to the various soil types for the production of cotton. A mimeographed supplement has been issued giving the relation of the various geological formations to the soil series of the state. Credit is due Mr. J. C. Scott, Junior Reviewing Appraiser, Farm Credit Administration, of Houston, Mississippi, for this valuable information. By compiling information on cotton fertilizer experiments that have been run on such soil types as occur in Mississippi we are able to use information from other cotton growing states.

Results of cotton fertilizer experiments have been studied very largely heretofore on the per acre basis. An effort is being made to direct the study of the experiments recorded in this bulletin to a farm management basis. Form 1 encourages the study of the profit per dollar invested in fertilizer, the dollars invested per farm being usually the limiting factor in regard to the use of fertilizer.

AMOUNTS OF NITROGEN, PHOSPHORUS AND POTASH TO APPLY PER ACRE

The results of experiments immediately following show applications of the three plant nutrients, nitrogen, phosphorus and potash in varying quantities and proportions. Such combinations are usually provided as to hold two of the nutrients constant while one varies. From the results of the one varying, indications may be secured as to the most profitable amount of that nutrient to apply per acre. For instance, 24-48-24, 36-48-24 and 48-48-24 fertilizers may be compared to determine the most profitable amount of nitrogen per acre. The symbol N-P-K represents the pounds of nitrogen, phosphorus and potash, respectively, per acre.

How much nitrogen per acre is most profitable on each of the various soil types? How much phosphorus? How much potash? Use Form 1.

How is the response of cotton to each of the plant nutrients influenced by (1) a cover crop having been grown on the land during the previous winter? (2) the crop being grown in a rotation? (3) weather conditions?

I

SUMMARY OF SOUTH CAROLINA COASTAL PLAINS CO- OPERATIVE FERTILIZER EXPERIMENT

PLAN OF EXPERIMENT

In all of these tests a regular three-year soil-building rotation has been followed. This consists of cotton the first year, followed by oats and peas or soybeans the second year, and corn with cowpeas or soybeans interplanted the third year. It is the plan of these tests to have one ton of ground limestone applied per acre to one-half of each plot every three years. This has been done wherever possible.

The general plan of the tests, as outlined at the beginning of the work, was to allow for what was believed to be reasonably heavy application of a fertilizer adapted to cotton for the soil in question. Using this as a basis each element in the complete fertilizer was varied in turn, meanwhile keeping the application of the other two constant. In addition on a series of plots the rate of application was increased from nothing to 1400 pounds and in some cases as high as 2,400 pounds per acre, depending upon the soil type and land available for plot work.

From 1920 to 1925 inclusive, fertilizers carrying the same proportions of plant food were applied to all three fertilized crops; to corn at approximately three-fourths of the rate of the cotton applications; and to oats at approximately one-half the rate to cotton. Beginning with 1926, however, the plan of the tests was modified so that since that time the corn and oats have received no fertilizer other than uniform applications of readily available form of nitrogen to all plots. It is believed that this is more nearly in accordance with actual farm practices, and therefore of more benefit to farmers as a whole.

It was also realized in 1926 that the rate of application of nitrogen to cotton was not sufficient for most economical returns, so that beginning with that crop the amount of nitrogen was increased by one-half. That is to say, prior to this time the amount of nitrogen as expressed in the formula was the total applied, two-as much more was added, as a side application within about two weeks after chopping. When the application of nitrogen was increased in 1926, the amount as expressed in the formula was all applied prior to planting, and in addition one-half

as much more added, as a side application within about two weeks after chopping. This fact should be kept in mind in studying the results.

The source of phosphorus has always been acid phosphate of approximately 16 percent phosphoric acid content, all applied prior to planting. The nitrogen applied before planting has been derived partly from dried blood, as a representative organic source carrying neither phosphorus nor potash, and partly from either nitrate of soda or sulphate of ammonia. The side application of nitrogen has usually been nitrate of soda. Potash has been derived from manure salts or kainit, all applied prior to planting.

In the Coastal Plains tests, where level uniform fields are available, check plots receiving a standard rate of application of complete fertilizer were uniformly distributed throughout the series, every fourth plot being a check plot.

In reporting the yields, only the averages of all check plots in a particular test are given, and these placed where they normally occur in the order of treatments.

Date of applying fertilizer in relation to planting date—one week before planting.

Average planting date—April 20. **Earliest planting date during the test**—April 15.

Latest planting date—April 25.

Variety used—Cleveland.

Method of applying fertilizer in relation to the bed—in the furrow below the seed.

Size of plots—1/10 and 1/20 acre. **No of replications**—two.

Width of rows—3½ feet.

The experiment has been run continuously on the same land, each plot following itself each year of the experiment.

Table 1. A. Norfolk Sand at State Park, South Carolina Using 1000 Lbs. 3¼-8-4 (5-8-4 Since 1926) Per Acre As Basis.

	Pounds N-P-K Per Acre	1920	1923 Yield in	1924	1926 Pounds Seed	1927 Cotton	Av.
Nitrogen and Potash Constant							
No Phosphorus	33 1/3-0-40	361	529	245	398	139	334
2 Percent Phos. Acid.....	33 1/3-20-40	504	724	459	625	243	511
4 Percent Phos. Acid.....	33 1/3-40-40	581	711	417	695	426	566
6 Percent Phos. Acid.....	33 1/3-60-40	618	878	462	709	447	623
8 Percent Phos. Acid.....	33 1/3-80-40	647	859	597	815	631	710
10 Percent Phos. Acid.....	33 1/3-100-40	646	940	537	770	693	717
Phosphorus and Potash Constant							
No Nitrogen	0-80-40	220	285	500	346	168	304
1½ Percent Nitrogen.....	16½-80-40	189	596	597	519	747	530
3½ Percent Nitrogen.....	33½-80-40	647	859	597	815	631	710
5 Percent Nitrogen.....	50-80-40	776	967	455	829	725	750
6½ Percent Nitrogen.....	66½-80-40	495	904	631	697	458	637
Nitrogen and Phosphorus Constant							
No Potash	33 1/3-80-0	715	276	218	597	344	430
2 Percent Potash.....	33 1/3-80-20	722	885	342	1055	582	717
4 Percent Potash.....	33 1/3-80-40	647	859	597	815	631	710
6 Percent Potash.....	33 1/3-80-60	472	873	555	957	536	679
Rate of Application of Complete Fertilizer (3¼-8-4)							
No Fertilizer	0-0-0	177	44	293	136	96	149
400 Pounds	13 1/3-32-16	549	526	529	433	309	469
800 Pounds	26 2/3-64-32	417	872	525	736	458	602
1000 Pounds	33 1/3-80-40	647	859	597	815	631	710
1200 Pounds	40-96-48	525	1028	672	992	706	785
1600 Pounds	53 1/3-128-64	536	1287	732	950	851	871

The experiment at State Park is conducted on the State Hospital Farm in Richland county. The soil type is Norfolk sand, very low in fertility. The drainage is excessive, and as a result it is often difficult to obtain a stand, and the crops often suffer from drought. Every effort has been made to increase the organic matter content of the soil by turning under numerous cover crops. This has had a beneficial effect, although the yields are still low. State Park is on about the same latitude as the northern boundary of Mississippi.

Reference: South Carolina Experiment Bulletin 245, "Cotton Fertilizer Experiments," page 11, Clemson College, South Carolina.

Table 2. B. Ruston Sandy Loam At Bishopville, South Carolina Using 600 Lbs. 3½-8-3 (5-8-3 Since 1926) As Basis

	Pounds N-P-K Per Acre	1921	1922	1923	1924	1925	1926	1927	Av.
Yield in Lbs. Seed Cotton Per Acre									
Nitrogen and Potash Constant									
No Phosphorus	20-0-18	1270	768	1271	848	836	1590	852	1062
2 Percent Phos. Acid.....	20-12-18	1212	864	1244	842	873	1525	775	1048
4 Percent Phos. Acid.....	20-24-18	1170	858	1201	785	828	1790	718	1050
6 Percent Phos. Acid.....	20-36-18	1307	896	1369	897	923	1915	715	1146
8 Percent Phos. Acid.....	20-48-18	1325	900	1296	920	928	1870	866	1158
10 Percent Phos. Acid.....	20-60-18	1318	910	1366	876	906	1852	844	1153
Phosphorus and Potash Constant									
No Nitrogen	0-48-18	800	430	946	425	773	1535	437	764
1½ Percent Nitrogen.....	10-48-18	1048	790	1186	808	746	1797	641	1002
2½ Percent Nitrogen.....	15-48-18	1065	915	1128	1012	846	1805	707	1068
3½ Percent Nitrogen.....	20-48-18	1325	900	1296	920	928	1870	866	1158
4½ Percent Nitrogen.....	25-48-18	1315	910	1311	985	963	1710	844	1148
5 Percent Nitrogen.....	30-48-18	1435	975	1493	997	1011	1785	948	1235
6½ Percent Nitrogen.....	40-48-18	1540	1152	1426	973	971	1820	1053	1277
8½ Percent Nitrogen.....	50-48-18	1605	1150	1526	1035	963	1660	1180	1303
Nitrogen and Phosphorus Constant									
No Potash	20-48-0	1487	737	1376	910	986	1718	913	1161
1 Percent Potash.....	20-48-6	1410	865	1286	930	1103	1935	938	1210
2 Percent Potash.....	20-48-12	1432	928	1276	910	1101	1883	995	1218
3 Percent Potash.....	20-48-18	1325	900	1296	920	928	1870	866	1158
4 Percent Potash.....	20-48-24	1283	935	1306	883	1011	1842	882	1163
Rate of Application of Complete Fertilizer (3½-8-3)									
No Fertilizer	0-0-0	920	430	726	612	743	1725	448	801
200 Pounds	6½-16-6	1103	705	1056	808	960	1687	591	987
400 Pounds	13½-32-12	1282	834	1166	851	900	1788	764	1084
600 Pounds	10-48-18	1325	900	1296	920	928	1870	866	1158
800 Pounds	26½-64-24	1420	1113	1296	927	993	1865	894	1215
1000 Pounds	33½-80-30	1527	1197	1326	933	926	1743	781	1205
1200 Pounds	40-96-36	1510	1156	1503	1134	941	1958	880	1297
1400 Pounds	46½-112-42	1815	1252	1261	1155	913	1945	1103	1349
1600 Pounds	53½-128-48	1840	1238	1498	1063	1006	2173	886	1386

The experiment listed as Bishopville is conducted on the farm of Ex-Governor R. L. Manning in Lee County. The results secured in the seven-year period, 1921-1927 inclusive, are presented in Table 2. The soil type is Ruston sandy loam. When the experiment was begun in 1921, the field was in a reasonably fertile condition, although the effect of the fertilizer applications was clearly evident from the first. The rate of application to the cotton has been 600 pounds of complete fertilizer per acre with basic analysis 3½-8-3 (5-8-3 since 1926). This includes the side application of nitrogen.

Bishopville is on about the same latitude as the following Mississippi counties: Itawamba, Lee, Pontotoc, Lafayette, Panola, Quitman, and Coahoma.

Reference: South Carolina Experiment Bulletin 245, "Cotton Fertilizer Experiments," Page 8, Clemson College, South Carolina.

**Table 3. C. Greenville Clay Loam at Trenton, South Carolina Using 800 Pounds
3½-8-3 (5-8-3 Since 1926) Per Acre As Basis**

	Pounds N-P-K Per Acre	1921 Yield	1922 in Lbs.	1923 Seed	1924 Cotton	1925 Per Acre	1926	Av.
Nitrogen and Potash Constant								
No Phosphorus	26 ⅔-0-24	740	1047	1534	1483	1050	1026	1147
2 Percent Phos. Acid.....	26 ⅔-16-24	859	1076	1379	1311	1042	1138	1134
4 Percent Phos. Acid.....	26 ⅔-32-24	897	998	1374	1348	1113	1138	1145
6 Percent Phos. Acid.....	26 ⅔-48-24	814	1070	1444	1341	989	1168	1138
8 Percent Phos. Acid.....	26 ⅔-64-24	807	1080	1429	1363	955	1123	1126
10 Percent Phos. Acid.....	26 ⅔-80-24	822	1206	1024	1340	1030	1097	1086
Phosphorus and Potash Constant								
No Nitrogen	0-64-24	537	855	1126	1071	790	909	881
1 ⅔ Percent Nitrogen.....	13 ⅓-64-24	699	930	1342	1300	903	993	1028
2 ½ Percent Nitrogen.....	20-64-24	919	1084	1418	1367	772	1058	1103
3 ⅓ Percent Nitrogen.....	26 ⅔-64-24	807	1080	1429	1363	955	1123	1126
4 ⅓ Percent Nitrogen.....	33 ⅓-64-24	957	886	1668	1476	708	1105	1133
5 Percent Nitrogen.....	40-64-24	845	1076	1528	1495	869	1137	1158
6 ⅔ Percent Nitrogen.....	53 ⅓-64-24	868	972	2046	1423	907	1160	1229
8 ⅓ Percent Nitrogen.....	66 ⅔-64-24	905	916	2360	1483	828	1198	1282
Phosphorus and Nitrogen Constant								
No Potash.....	26 ⅔-64-0	878	1027	1527	1307	899	1056	1116
1 Percent Potash.....	26 ⅔-64-8	812	1118	1429	1326	978	1130	1132
2 Percent Potash.....	26 ⅔-64-24	807	1080	1429	1363	955	1123	1126
4 Percent Potash.....	26 ⅔-64-32	818	1117	1120	1277	917	1058	1051
Rate of Application of Complete Fertilizer (3½-8-3)								
No Fertilizer.....	0-0-0	657	536	726	1033	940	846	790
200 Pounds	6 ⅔-16-6	687	826	1106	920	1090	969	933
400 Pounds	13 ⅓-32-12	736	929	1281	1145	940	1082	1019
600 Pounds	20-48-18	793	1102	1311	1318	910	1071	1084
800 Pounds	26 ⅔-64-24	807	1080	1429	1363	955	1123	1126
1000 Pounds	33 ⅓-80-30	835	1192	1251	1325	1090	1014	1118
1200 Pounds	40-96-36	930	1091	1577	1483	809	1078	1161
1400 Pounds	46 ⅔-112-42	911	1095	1064	1453	828	1123	1079
1600 Pounds	53 ⅓-128-48	1012	1218	1165	1603	876	988	1144

The experiment at Trenton was conducted on the farm of Mr. B. B. Bouknight, and the soil is a rather sandy clay loam probably belonging to the Greenville series. It is a highly developed Coastal Plains soil, and at the time this experiment was begun in 1921 the field was in a high state of cultivation, having received very heavy applications of fertilizer in previous years, which probably accounts for the apparent lack of benefit from the application of the mineral fertilizer elements especially during the first years. In 1926 the cotton was a complete failure because of late planting and unfavorable moisture conditions. Trenton is on about the same latitude as the northern tier of Mississippi counties.

Reference: South Carolina Experiment Bulletin 245, "Cotton Fertilizer Experiments," page 10, Clemson College, South Carolina.

Form 1. Suggestive Method for Determining the Most Economical Cotton Fertilizer According to Experiments

[illegible]

1/ Fill in here the average amount of money usually spent annually for cotton fertilizer. In the case of "No Fertilizer" use at least as many acres as are used in any fertilizer trial.

2/ By increasing the fertilizer per acre, fewer acres can be fertilized with the given investment. Credit should be allowed for the use of the reduced acres.

Estimate the yield per acre according to the use of the reduced acres. Credit should be allowed for the use of the reduced acres, that may be figured also to get a T. D. N. comparison.

II

FERTILIZER EXPERIMENTS WITH COTTON IN ALABAMA

From 1911 through 1922 the Agronomy Department of this station conducted more than two hundred fertilizer experiments to determine the best fertilizer or combination of fertilizers for cotton on each of the principal soil regions of Alabama. With the results of this work as a basis, other cooperative experiments were started in 1923 to determine the rate and ratio that nitrate of soda, superphosphate, and muriate of potash should be used when applied in greater quantities than the minimum application.

The work was begun in the spring of 1923 and continued through 1927. During the five years 170 conclusive individual experiments were made. The tables show the number of experiments on each soil group.

Method: Cooperative experiments by this department are conducted on the farm of men who are known to be especially interested and have above average ability for work of this nature. Many of the cooperators have been doing work of this nature in cooperation with the department for ten to fifteen years. New men are selected almost entirely on recommendation of the county agent, who, in practically every case, spend time in seeing that the experiment is properly carried out.

The term "an experiment" refers to a single year's work on one series of plots. The method of replication used by this station is to place a single series of plots on any one farm and repeat the experiment on the same soil series in other communities, or, perhaps, in other counties.

The land used for each experiment was selected and measured by a representative of the experiment station. Two hundred seventy-three experiments, were located to obtain the average results from the 170 experiments recorded in the tables. Poor, irregular stands and lack of uniformity of the soil as shown by the yields of the unfertilized plots were the chief causes for the non-use of the remaining 103 experiments. Fertilizers for each plot and instructions concerning their application were sent to each cooperator. Each experiment was inspected one or more times during the growing season. All of the phosphoric acid, all of the potash, and one-fourth of the nitrogen were applied in the bed immediately before planting; the remaining three-fourths of the nitrogen was applied just prior to the first cultivation after the cotton was chopped.

Earliest planting date during the test—late March in South Alabama.

Latest planting date—early May in North Alabama.

Fertilizer was applied in various ways but usually in bed.

Size of plots—1/20 acre.

Width of rows—Various widths, usually 3 or 3½ feet.

No cover crops were grown previous to any of these experiments.

The experiments on Houston and Oktibbeha soils were run in Central Alabama, while those on Greenville and Norfolk soils were conducted in Central and Southern Alabama.

Explanation of Terms and Values. All of the fertilized plots in the experiments reported in this publication received a minimum application of 325 pounds of fertilizer per acre, composed of 100 pounds of nitrate of soda, 200 pounds of superphosphate, and 25 pounds of muriate of potash. In the discussion which follows, this application is termed the "base plot" (Plot 2). Any reference to "second increment," "Additional material," "Additional Nitrogen, Phosphoric acid, or Potash," or any similar terms have to do with the additional fertilizer or fertilizing material above that used as the base application. The reader should keep in mind that earlier work reported by this station showed the value of the different fertilizer ingredients used in the base application and that this publication is to record the results of experiments carrying heavier fertilization than the base plot.

A study of the tables will show that there are four possible values for each plant nutrient. For example: the yield on Plot 3 minus the yield on Plot 2 gives the increase due to the second increment of potash alone; the yield on Plot 5 minus the yield on Plot 4 gives the increase due to the second increment of potash in the presence of the second increment of nitrogen; the yield on Plot 8 minus the yield

on Plot 7 gives the values of potash in the presence of a second increment of phosphoric acid, and the yield of Plot 10 minus the yield on Plot 9 gives the value of the second increment of potash in the presence of second increments of both nitrogen and phosphoric acid. By similar calculations four values can also be obtained for phosphoric acid and for nitrogen. In most of the averages of experiments herein recorded the greatest increase due to a single fertilizing element was obtained when the other essential elements were present in the exact proportions as they were used on the base plot. Unless there is a statement to the contrary, any discussion of the value of the increase due to either nitrogen, phosphoric acid, or potash will have reference to their value on Plot 10 and will be obtained as follows:

The yields on Plot 10 minus the yield on Plot 8 equals the value of the second increment of nitrogen. ,

The yield on Plot 10 minus the yield on Plot 5 equals the value of the second increment of phosphoric acid.

The yield on Plot 10 minus the yield on Plot 9 equals the value of the second increment of potash.

Plot 12, carrying three times the application of the base plot, was added to the experiment in 1924.

Table 4. Rate and Ratio Fertilizer Experiments With Cotton in Alabama, 1923-27. Average Yield in Pounds Seed Cotton Per Acre and Increase Over No Fertilizer

Plot No.	Fertilizer Per Acre	Soil Type	HOUSTON			OKTIBBEHA			GREENVILLE			NORFOLK		
			10			8			34*			45		
			Yield	Increase	Yield	Yield	Increase	Yield	Yield	Increase	Yield	Yield	Increase	Yield
1	No Fertilizer	Lbs. N-P-K Per Acre 0-0-0	696	.....	349	.....	.....	399	.....	.....	354	.....	.....	.....
2	100 lbs. Nitrate of Soda..... 200 lbs. Superphosphate..... 25 lbs. Muriate of Potash.....	15-32-12	818	132	551	169	710	297	716	360	.....	.....	.....	.....
3	100 lbs. Nitrate of Soda..... 200 lbs. Superphosphate..... 50 lbs. Muriate of Potash.....	15-32-24	811	115	523	141	724	311	733	377	.....	.....	.....	.....
4	200 lbs. Nitrate of Soda..... 200 lbs. Superphosphate..... 25 lbs. Muriate of Potash.....	30-32-12	850	154	599	217	839	426	780	424	.....	.....	.....	.....
5	200 lbs. Nitrate of Soda..... 200 lbs. Superphosphate..... 50 lbs. Muriate of Potash.....	30-32-24	856	160	585	203	854	441	828	472	.....	.....	.....	.....
6	No Fertilizer	0-0-0	694	.....	380	.....	413	.....	361	.....	.....	.....	.....	.....
7	100 lbs. Nitrate of Soda..... 400 lbs. Superphosphate..... 25 lbs. Muriate of Potash.....	15-64-12	821	125	548	166	763	350	761	405	.....	.....	.....	.....
8	100 lbs. Nitrate of Soda..... 400 lbs. Superphosphate..... 50 lbs. Muriate of Potash.....	15-64-24	880	184	621	239	789	376	770	414	.....	.....	.....	.....
9	200 lbs. Nitrate of Soda..... 400 lbs. Superphosphate..... 25 lbs. Muriate of Potash.....	30-64-12	880	184	756	374	895	482	833	477	.....	.....	.....	.....
10	200 lbs. Nitrate of Soda..... 400 lbs. Superphosphate..... 50 lbs. Muriate of Potash.....	30-64-24	866	170	773	391	926	513	913	557	.....	.....	.....	.....
11	No Fertilizer	0-0-0	699	.....	418	.....	426	.....	353	.....	.....	.....	.....	.....
	Average no fertilizer	0-0-0	696	.....	382	.....	413	.....	356	.....	.....	.....	.....	.....
	No fertilizer	0-0-0	696	.....	382	.....	493	.....	371	.....	.....	.....	.....	.....
2	100 lbs. Nitrate of Soda..... 200 lbs. Superphosphate..... 25 lbs. Muriate of Potash.....	15-32-12	818	122	551	169	829	336	740	369	.....	.....	.....	.....
10	200 lbs. Nitrate of Soda..... 400 lbs. Superphosphate..... 50 lbs. Muriate of Potash.....	30-64-24	866	170	773	391	1059	566	946	575	.....	.....	.....	.....
12	300 lbs. Nitrate of Soda..... 600 lbs. Superphosphate..... 75 lbs. Muriate of Potash.....	45-96-36	942	246	933	551	1184	691	1014	643	.....	.....	.....	.....

*Plot 12 on Greenville soil is an average of only 24 experiments

Reference: Alabama Agricultural Experiment Station Bulletin 228, February 1929, "Fertilizer Experiments With Cotton," Auburn, Alabama.

III

Previous to the work reported in Table 4, one or more experiments had been placed in each county of the State during 1911-22. For various reasons a number of experiments were discarded, leaving only 57 counties represented. One hundred forty-three farmers cooperated with the Experiment Station in conducting these experiments. The results have been divided into groups in accordance with the several distinct soil divisions of the State.

METHODS

A representative from the Experiment Station selected the land and measured the plots for each experiment. Fertilizers for each plot and instructions concerning their application were sent by the Experiment Station to the cooperator. Each experiment was inspected one or more times during the growing season. All fertilizers, except nitrate of soda, were applied in the drill before planting. Previous to 1920, the nitrate of soda was applied when the plants were six to eight inches tall. During and since 1920 the nitrate of soda was applied at the first cultivation after cotton was thinned to a stand.

Table 5. Results of Fertilizer Experiments With Cotton in Alabama, 1911-22

Plot No.	Fertilizer Per Acre --Lbs.	N-P-K Lbs. Per Acre	LOWER COASTAL PLAIN				BLACK BELT				UPPER COASTAL PLAIN				
			NORFOLK		GREENVILLE		Yield	Increase over Av.		Yield	NORFOLK		Yield	GREENVILLE	
			24		64			No Fert.	Increase over Av.		No Fert.	46 Experiments in Both Groups			
			Yield	over Av.	Yield	over Av.			Yield			over Av.		Yield	over Av.
			Number of Experiments	Soil Type	Yield	over Av.	Yield	over Av.	Yield	over Av.	Yield	over Av.	Yield	over Av.	Yield	over Av.	Yield	over Av.
1	200 C. S. M *	12-0-0	542	80	542	126	651	108	637	177	768	183			
2	200 Superphos	0-32-0	535	73	540	64	658	115	582	122	672	87			
3	No fertilizer	0-0-0	451	.....	451	.....	545	.....	448	.....	564	.....			
4	200 Kamit	0-0-24	606	144	541	65	668	125	588	128	629	44			
5	200 C. S. M *	12-38-0	650	188	680	204	717	174	725	265	825	240			
6	200 C. S. M *	12-0-24	714	252	685	209	723	180	715	255	805	220			
7	No fertilizer	0-0-0	475	.....	492	.....	546	.....	469	.....	592	.....			
8	240 Superphos	0-38-25	655	193	639	163	714	171	647	187	712	137			
9	200 C. S. M *	12-38-25	803	341	741	265	799	256	782	322	878	293			
10	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
11	No fertilizer	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
12	100 Nit. Soda	15-38-12	763	301	757	281	770	227	805	345	918	333			
13	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
14	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
15	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
16	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
17	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
18	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
19	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
20	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
21	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
22	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
23	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
24	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
25	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
26	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
27	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
28	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
29	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
30	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
31	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
32	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
33	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
34	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
35	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
36	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
37	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
38	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
39	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
40	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
41	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
42	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
43	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
44	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
45	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
46	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
47	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
48	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
49	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
50	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
51	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
52	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
53	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
54	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
55	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
56	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
57	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
58	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
59	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
60	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
61	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
62	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
63	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
64	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
65	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
66	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
67	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
68	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
69	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
70	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
71	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
72	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
73	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
74	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
75	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
76	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
77	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
78	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
79	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
80	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
81	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
82	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
83	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
84	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
85	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
86	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
87	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
88	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
89	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
90	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
91	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
92	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
93	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
94	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
95	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
96	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
97	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
98	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			
99	240 Superphos	12-38-12	723	261	745	269	773	230	800	340	883	298			
100	100 Kamit	0-0-0	460	.....	482	.....	539	.....	464	.....	600	.....			

The increase yields attributed to fertilizers have been calculated in this bulletin as follows: the increase due to acid phosphate is obtained by subtracting the yield of plot six from that of plot nine; the increase due to 200 pounds of kainit is obtained by subtracting the yield of plot five from that of plot nine; the value of 100 pounds of kainit per acre is found by subtracting the yield of plot five from the yield of plot ten; and the value of cottonseed meal is obtained by subtracting the yield of plot eight from that of plot nine. To find the value of nitrate of soda, the yield of plot ten is subtracted from that of plot twelve. The figure thus obtained is added to, or subtracted from (as the case may be) the value of cottonseed meal which was obtained as explained above.

- Source of Nitrogen—Cottonseed meal containing 7½% ammonia.
- Source of Phosphorus—Superphosphate containing 16% phosphoric acid.
- Source of Potash—Kainit containing 12½% potassium.
- Date of applying fertilizer in relation to planting date—immediately before.
- Earliest planting date during the test—Late March in Southern Alabama.
- Latest planting date during the test—Early May in Northern Alabama.
- Varieties used each year—Different farmers used different varieties.
- Size of plots—1/10 acre.
- Width of rows—3 to 4 feet.
- The experiment has not been run continuously on the same land.
- Cover crops have not been grown preceding any of these experiments.
- Boll weevil control measures used—None.

Reference: Alabama Agricultural Experiment Station, Bulletin 219, Tables 1. 3 and 4, March 1923, "Fertilizer Experiments With Cotton," Alabama Polytechnic Institute, Auburn, Alabama.

IV

Table 6. Cotton Fertilizer Analysis Test on Olivier Silt Loam At The Raymond Branch Experiment Station, Raymond, Mississippi

Pounds N-P-K Per Acre	Equivalent to 600 Lbs. Per Acre of	Increase Over No Fertilizer in Pounds of Seed Cotton Per Acre									
		1925	1926	1927	1928	1929	1930	1931*	1933	1934	9 Yr.
		Varying Analysis (Rate 600 Pounds Per Acre)									
24-48-48	4-8-8	374	516	758	483	411	500	554	664	290	506
24-48-36	4-8-6	255	470	657	551	507	510	673	629	330	509
24-48-24	4-8-4	224	425	498	401	536	399	597	632	358	452
24-48-12	4-8-2	311	470	519	323	462	384	607	546	308	437
24-48-0	4-8-0	351	383	286	247	241	198	516	395	239	317
48-48-24	8-8-4	493	696	688	545	593	646	746	807	487	633
36-48-24	6-8-4	464	507	604	578	583	601	773	826	417	595
24-36-24	4-6-4	510	562	543	481	477	550	755	596	398	541
24-24-24	4-4-4	303	424	527	467	562	503	623	610	389	490
Equivalent to 4-8-4 at the rate of:											
48-96-48	1200 Lbs.	638	657	938	846	1061	992	1145	1253	628	906
72-144-72	1800 Lbs.	828	1162	1100	924	1127	966	1203	1318	802	1048
96-192-96	2400 Lbs.	741	1330	1056	1273	1242	1090	1017	1535	638	1102
Yield Without Fertilizer											
		1465	1021	901	544	756	976	823	896	541	880

* No experiment in 1932 due to lack of funds.

- Soil Type: Good valley soil, Olivier silt loam.
- Number of Years that land has been in cultivation—80, so it is said.
- Dates of Applying Fertilizer—1926, April 11; 1927, April 18. 1928, April 19; 1929, April 13; 1930, April 16; 1931, April 11; 1933, April 28. 1934, April 13.
- Date of Planting—1925, May 14; 1926, April 17; 1927, April 20; 1928, April 21; 1929, April 19; 1930, April 23. 1931, April 17; 1933, May 31; 1934, April 19.
- Fertilizer Used—Carrying nitrogen, Chilean Nitrate of Soda; Phosphorus, Superphosphate; Potash, Muriate of Potash.
- Method of Applying Fertilizer—Put in bottom of water furrow and bedded on.
- Width of Rows—Three and one-half feet.
- Spacing of Plants in Drill—Two stalks in hills a foot apart.

Size of Plots—One-twentieth acre.
Number of replications—Three.
Variety of Cotton Used—1925-31, Lone Star 65; 1933-34, Starfos*
 Cotton was always poisoned when needed, too late in 1934, however. Good stands were secured practically every year.
 *Starfos is a cross between Lone Star 65 and Delfos 6102.
Reference: Annual reports of the station.

V

Table 7. Cotton Fertilizer Analysis Test on Lufkin Clay Loam on The Farm of G. Yeates, Starkville, Mississippi, 1926-34

Pounds N-P-K Per Acre	Equivalent to 600 Lbs. Per Acre of	Increase Over No Fertilizer in Pounds Seed Cotton Per A.									
		1926	1927	1928	1929	1930	1931	1932	1933	1934	Av.
24-48-48	4-8-8	382	535	118	580	279	421	278	227	335	351
24-48-36	4-8-6	385	440	90	559	268	440	226	117	410	333
24-48-24	4-8-4	352	473	85	526	220	489	329	172	423	341
24-48-12	4-8-2	288	369	30	450	146	511	304	223	399	302
24-48-0	4-8-0	327	410	36	468	85	479	283	198	288	286
48-48-24	8-8-4	548	703	148	839	205	757	489	196	262	461
36-48-24	6-8-4	419	614	94	741	228	613	428	264	310	412
24-36-24	4-6-4	337	517	81	513	214	480	337	214	240	326
24-24-24	4-4-4	250	438	50	414	132	415	320	181	286	276
4-8-4 at the rate of:											
48-96-48	1200 Lbs.	537	866	240	975	345	765	63	387	349	503
72-144-72	1800 Lbs.	625	1144	341	1101	434	844	61	356	432	593
96-192-96	2400 Lbs.	791	1323	557	1257	494	927	106	396	446	700
Yield Without Fertilizer											
		273	568	49	482	360	153	226	94	193	266

Fertilizer used—Nitrate of Soda, Superphosphate, Muriate of Potash.
Time and Method of Applying Fertilizer—In water furrow by hand and bedded on.
Width of Rows—Three and one-half feet.
Size of Plots—1/20 acre.

VI

Table 8. Cotton Fertilizer Analysis Test on Ochlockonee Fine Sandy Loam at State College, Mississippi (1925-1934)

Pounds N-P-K Per Acre	Equivalent to 600 Lbs. Per Acre of	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	Av.
24-48-48	4-8-8	286	289	692	609	582	601	177	510	593	351	469
24-48-36	4-8-6	319	208	640	526	554	586	203	465	541	354	440
24-48-24	4-8-4	255	235	578	605	521	520	234	360	507	288	411
24-48-12	4-8-2	190	171	411	362	325	269	266	529	585	377	348
24-48-0	4-8-0	-12	13	54	73	4	92	86	-27	230	103	61
48-48-24	8-8-4	226	104	469	395	335	513	141	427	613	427	365
36-48-24	6-8-4	272	168	504	512	405	469	168	610	564	390	406
24-36-24	4-6-4	223	138	528	465	376	515	201	652	537	450	408
24-24-24	4-4-4	165	130	511	405	295	483	185	638	557	443	381
4-8-4 at the rate of												
48-96-48	1200 Lbs.	633	272	841	760	472	673	186	643	667	449	559
72-148-72	1800 Lbs.	649	223	810	656	514	800	-12	577	662	302	518
96-192-96	2400 Lbs.	549	228	880	614	382	899	20	509	493	365	494
Yield Without Fertilizer												
		560	371	877	602	395	590	444	704	320	735	560

Fertilizer Used—Sodium nitrate, superphosphate, muriate of potash. The nitrogen fertilizer has been varied.
Method of Applying Fertilizer—In water furrow by hand and bedded on.
Width of Rows—Three and one-half feet.

Size of Plots—6 rows, 95 feet long.

Date of Planting—April 25, approximately.

Reference: Reports of the station, 1925-34.

VII

Table 9. Test of Various Amounts of Fertilizer For Cotton on Grenada Silt Loam (Hill Land) At Holly Springs, Mississippi

Fertilizer Pounds N-P-K	Per Acre Equivalent to	Increase over no fertilizer in Lbs. Seed Cotton			
		1930	Per Acre 1933	1934	3 Yr. Av.
12-24-12	200 Lbs. 6-12-6	46	329	243	206
18-36-18	300 Lbs. 6-12-6	64	463	276	267
24-48-24	400 Lbs. 6-12-6	137	517	333	329
30-60-30	500 Lbs. 6-12-6	146	685	376	402
36-72-36	600 Lbs. 6-12-6	181	764	398	447
No Fertilizer		682	620	628	643

Size of Plot—1/40 acre repeated 4 times.

Planting Date—1934, May 3.

Reference: Annual reports of the station.

VIII

Table 10. Fertilizer Analysis Test on Cotton on Lintonia Valley Land—Holly Springs Station (1925-1934) Holly Springs, Mississippi

Fertilizer Pounds N-P-K	Per Acre: Equivalent to 600 Lbs. of	Increase in Pounds of Seed Cotton Per Acre Over No Fertilizer									
		1925	1926	1927	1928	1929	1930	1931	1933	1934	Av.
24-48-48	4-8-8	435	908	372	812	1070	859	174	1096	760	718
24-48-36	4-8-6	316	758	265	817	936	696	60	1034	788	630
24-48-24	4-8-4	586	538	244	595	821	589	82	753	590	533
24-48-12	4-8-2	238	363	319	270	553	488	0	393	506	347
24-48-0	4-8-0	170	115	269	61	139	197	-47	-37	260	125
48-48-24	8-8-4	361	524	250	458	789	639	16	661	694	488
36-48-24	6-8-4	475	519	382	597	709	633	52	742	674	531
24-36-24	4-6-4	471	373	285	533	686	603	179	654	697	497
24-24-24	4-4-4	423	291	274	393	476	554	76	734	674	432
4-8-4 at the rate of		Varying Rate (Analysis 4-8-4)									
48-96-48	1200 Lbs.	774	738	433	760	791	782	48		630	619
72-144-72	1800 Lbs.	739	834	167	894	1012	959	-48			651
96-192-96	2400 Lbs.	484	1058	99	1081	1197	1061	-68			701
Yields Without Fertilizer											
		1561	1213	824	786	763	714	390	895	912	895

Soil Type—Improved valley land, Lintonia silt loam that has grown legumes each year since 1910. Superphosphate and nitrogenous fertilizers have been used each year.

Width of Rows—Three and one-half feet.

Planting Dates—1925, April 21, but did not germinate until after the middle of May, 1926, April 22.

Variety of Cotton—1925, Delfos 6102. 1926, Lone Star 65; 1927, Miss. Station Trice; 1928, Delfos 1341.

Size of Plots—One-twentieth acre repeated 3 times.

Source of Nitrogen—Nitrate of soda containing 15% and 16% nitrogen. The 16% nitrogen used in 1934.

Source of Phosphorus—Superphosphate containing 16% and 20% phosphoric acid.

Source of Potash—Muriate containing 50% potassium.

Date of applying fertilizer in relation to planting date—A few days prior to planting.

Average planting date—April 29. **Earliest planting date during test**—April 22, 1926.

Latest planting date—May 28, 1927.

The experiment has been run continuously on the same land, each plot following itself each year of the experiment.

During what years have cover crops been grown on this land? 1932, turned in 1933.

What cover crop?—Austrian winter peas.

Were boll weevil control measures used?—Yes.

IX

Table 11. Cotton Fertilizer Analysis Test on Grenada Silt Loam at Holly Springs Branch Experiment Station, Holly Springs, Mississippi

Fertilizer Pounds N-P-K	Per Acre Equivalent to 600 Lbs. of:	Increase Over No Fertilizer in Pounds Seed Cotton									
		Per Acre									Av. 9 Years
		1925	1926	1927	1928	1929	1930	1931	1933	1934	
							Varying	2 / Analysis			
24-48-48	4-8-8	541	892	691	388	516	193	528	589	332	519
24-48-36	4-8-6	542	1083	672	414	472	205	536	558	301	531
24-48-24	4-8-4	465	1011	747	328	426	259	594	669	288	532
24-48-12	4-8-2	238	782	515	310	424	183	504	779	332	452
24-48-0	4-8-0	190	486	613	200	354	194	492	666	260	384
48-48-24	8-8-4	292	1093	701	314	402	375	788	940	353	584
36-48-24	6-8-4	272	493	645	303	455	346	816	872	331	504
24-36-24	4-6-4	263	498	650	235	384	289	452	761	275	423
24-24-24	4-4-4	281	446	481	220	343	299	350	691	188	366
24-60-48	4-10-8	-----	-----	-----	-----	-----	-----	-----	622	327	474*
24-72-48	4-12-8	-----	-----	-----	-----	-----	-----	-----	703	282	492*
24-48-60	4-8-10	-----	-----	-----	-----	-----	-----	-----	593	262	427*
24-48-72	5-8-12	-----	-----	-----	-----	-----	-----	-----	670	272	471*
4-8-4 at the rate of		Varying Rate (Analysis 4-8-4)									
48-96-48	1200 Lbs.	622	703	924	495	583	401	1106	1006	430	697
72-144-72	1800 Lbs.	801	905	1038	496	613	381	1230			780**
96-192-96	2400 Lbs.	985	946	1035	542	636	393	1476			859**
Average Yield of Five Plots Without Fertilizer											
		680	609	672	562	642	495	288	382	550	542

2/ 192 omitted due to lack of funds for purchasing fertilizer.

* Two years only.

** Seven years only.

Soil Type—Unimproved Grenada silt loam underlain by Wilcox sand that has been in cultivation for 75 years or more.

Date of Planting—1925, April 18; 1926, April 28; 1933, May 26; 1934, May 2.

Width of Rows—3 feet.

Size of Plots—1/20 acre repeated 3 times. Each plot consisted of four rows but only the two middle rows were used in recording results.

Variety of Cotton—1925, Mississippi Station Trice; 1926-27-28, Lone Star 65.

Source of Nitrogen—Nitrate of soda containing 15% and 16% nitrogen.

Source of Phosphorus—Superphosphate containing 16% to 20% phosphoric acid.

Source of Potash—Muriate containing 50% potash.

Date of applying fertilizer in relation to planting date—Shortly before, 6 or 7 days.

Average planting date—May 7. **Earliest planting date during the test**—April 25, 1930.

Latest Planting Date—May 15, 1933.

Variety used each year since 1928—Stoneville No. 2, until 1930; Stoneville No. 3 from 1930 to 1934.

How was fertilizer applied in relation to the bed—In list (opened).

The experiment has been run continuously on the same land.

Table 12. Rate of Fertilizer Application Test on Tifton Sandy Loam—Tifton, Georgia

Table 12. Rate of Fertilizer Application and Seed Cotton Yield														
Fertilizer Per Acre		Yield in Pounds Seed Cotton Per Acre												
N-P-K	Equivalent to 2 1/2-9.5 at the rate of	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	6 Year Average 1924-29	7 Year Average 1927-33	10 Year Average 1924-33
0-0-0	None	338	306	350	312	264	308	255	270	546	687	313	377	364
1 1/2-27-15	300 Pounds	685	565	722	472	646	949	425	577	856	967	673	699	486
15-54-30	600 Pounds	822	931	882	717	783	1055	598	850	1142	1236	865	912	902
22 1/2-81-45	900 Pounds	1145	1212	.....	984	1052	1162	784	1023	1216	1291	1111*	1073	1097**
30-108-60	1200 Pounds	.....	1528	1044	1053	1148	1284	988	1168	1382	1556	1211*	1226	1239**

* 5 years only.

** 9 years only.

The cotton work at the Tifton, Georgia, experiment station has been largely on a typical Tifton sandy loam with work also being done on a light phase of Tifton sandy loam which very closely resembles Norfolk sandy loam. The results of this work, therefore, should be applicable to both Tifton and Norfolk soil types.

Tifton, Georgia, is on about the same latitude as the following Mississippi counties: Adams, Franklin, Lincoln, Lawrence, Jefferson Davis, Covington, Jones and Wayne.

Source of Nitrogen—Nitrate of soda, containing 15% nitrogen.

Source of Phosphorus—Superphosphate containing 16% phosphoric acid.

Source of Potash—Muriate of potash containing 50% potash.

Date of applying Fertilizer in relation to planting date—10-14 days before planting.

Average planting date—April 1.

Variety Used—Petty's Toole.

Method of applying fertilizer in relation to the bed—Applied to furrow, bedded on.

Size of Plots—1/20 acre. No. of replications—4.

Widths of Rows—3.3 feet.

The experiment has not been run continuously on the same land.

Boll weevil control measures used—Mopped once, using about two pounds calcium arsenate per acre.

Reference: Georgia Coastal Plain Experiment Station Bulletin 13, page 18, table 8, "Cotton Production in the Coastal Plain of Georgia", Tifton, Georgia, June, 1934.
 1930 and Georgia Coastal Plain Experiment Station Bulletin 24, page 16, table 4, "Fourteenth Annual Report," Tifton, Georgia, June, 1934.

Table 13. Cotton—Nitrate of Soda Top Dressing Test on Tifton Sandy Loam. 600 Pounds 2½-9-5 Fertilizer (N-P-K) Applied At The Time of Planting

Fertilizer Per Acre														
Lbs. Nitrate of Soda Side Dressing	Lbs. Plant Nutrients From		Total	1924										
	Original Application 600 Lbs. 2 1/2-9-5	Side Dressing		1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	10 Year Average 1924-33
None	15-54-30	None	15-54-30	606	438	844	801	475	1400	846	851	1029	1080	837
50	15-54-30	7 1/2-0-0	22 1/2-54-30	701	364	997	800	560	1519	949	928	1153	1282	925
100	15-54-30	15-0-0	30-54-30	888	627	1146	950	605	1518	944	975	1091	1613	1036
150	15-54-30	22 1/2-0-0	37 1/2-54-30	1024	668	1104	1050	615	1672					
200	15-54-30	30-0-0												

This test has been in progress since 1924 to determine the increase in yield that may be obtained from varying the amounts of nitrate of soda applied as a top dressing. The cotton received 600 pounds of a 2½-9-5 fertilizer at planting, the top dressing being applied a few days before the first squares appeared.

The cotton work at the Georgia Experiment Station has been largely on a typical Tifton sandy loam with work also being done on a light phase of Tifton sandy loam which very closely resembles Norfolk sandy loam. The results of this work, therefore, should be applicable to both Tifton and Norfolk soil types.

Source of Nitrogen—Nitrate of soda containing 15% nitrogen.

Source of Phosphorus—Superphosphate containing 16% phosphoric acid.

Source of Potash—Muriate containing 50% potash.

Date of applying fertilizer in relation to planting date—10 to 14 days before planting.

Average planting date—April 1.

Variety used each year—Petty Toole.

How was fertilizer applied in relation to the bed!—Applied in furrow and bedded on. Fertilizer about 3 inches below seed. Note the location of Tifton, Georgia, as accompanying Table 12.

Reference: Georgia Coastal Plain Experiment Station Bulletin 13, page 6, "Cotton Production in the Coastal Plain of Georgia," Tifton, Georgia, June, 1930.
Georgia Coastal Plain Experiment Station Bulletin 21, page 13, "Thirteenth Annual Report," Tifton Georgia, June 1933, Georgia Coastal Plain Experiment Station Bulletin 24, table 7, "Fourteenth Annual Report," Tifton Georgia, June, 1934.

Size of Plots—1/20 Acre. **No of replications**—Two.

Width of Rows—3.3 feet.

The experiment has not been run continuously on the same land.

Cover Crops—None have been grown during the experiment.

Boll weevil control measures used—Mopped one time, at the rate of about 2 pounds calcium arsenate per acre each year.

Stage of growth when the cotton was top-dressed—At time of appearance of first squares.

XII

Table 14. Cotton—Potash Top Dressing Test on Tifton Sandy Loam, Tifton, Ga.
600 Pounds of 2½-9-5 Fertilizer (N-P-K) Applied at the Time of Planting. Top Dressed With Potash As Indicated

Fertilizer Per Acre				Yield in Pounds Seed Cotton Per Acre						
Lbs. Potash	Lbs. Plant Nutrients	From	Total	1929	1930	1931	1932	1933	5 Year	Acreage
Side Dressing	Original Application 600 Lbs. 2½-9-5	Side Dressing								
None	15-54-30	None	15-54-30	1346	968	945	869	1331	1092	
50	15-54-30	0-0-25	15-54-55	1352	862	1052	1096	1348	1142	
100	15-54-30	0-0-50	15-54-80	1466	934	1130	1098	1475	1221	
150	15-54-30	0-0-75	15-54-105	1494	1035	1216	1135	1698	1316	
200	15-54-30	0-0-100	15-54-130	1609	1128	1327	1181	1769	1403	

Note the location and soil type as given with Table 12.

Source of Nitrogen—Nitrate of soda containing 15% nitrogen.

Source of Phosphorus—Superphosphate containing 16% phosphoric acid.

Source of Potash—Muriate containing 50% potassium.

Date of applying fertilizer in relation to planting date—10-14 days before planting

Average planting date—April 1st.

Variety used each year—Petty's Toole.

How was fertilizer applied in relation to the bed—Applied to furrow, bedded or Side dressing made at time of appearance of first squares.

Size of plots—1/20 acre. **No. of replications**—Two.

Width of Rows—3.3 feet.

The experiment has not been run continuously on the same land.

Were boll weevil control measures used—Yes. **Number of applications and number of pounds per acre per application each year**—About 2 pounds calcium arsenate per acre.

Stage of growth of the cotton when top-dressed—At time of appearance of first squares.

Reference: Georgia Coastal Plain Experiment Station Bulletin 24, page 20, table 9, "Fourteenth Annual Report," Tifton Georgia, June, 1934.

XIII

FERTILIZER FORMULA TEST ON TIFTON SANDY LOAM AT TIFTON, GEORGIA

The cotton work at the Georgia Experiment Station has been largely on a typical Tifton sandy loam with work also being done on a light phase of Tifton sandy loam which very closely resembles Norfolk sandy loam. The results of this work, therefore, should be applicable to both Tifton and Norfolk soil types.

Table 15. Fertilizer Formula Test 1924-1929 Inclusive
Fertilizer: 500 Lbs. Per Acre Applied At Time of Planting

Fertilizer Per Acre		
N-P-K	Equivalent to 500 Lbs. Per Acre of:	Lbs. Seed Cotton Per Acre 6 Year Average
1 0-0-0	None.....	339
2 12½-35-25	2½-7-5.....	733
3 12½-40-25	2½-8-5.....	714
4 12½-45-25	2½-9-5.....	894
5 12½-50-25	2½-10-5.....	622
6 12½-60-25	2½-12-5.....	770
7 12½-70-25	2½-14-5.....	670
8 0-0-0	None.....	329
9 0-45-25	0-9-5.....	586
10 8½-45-25	1¾-9-5.....	747
11 12½-45-25	2½-9-5.....	808
12 16¾-45-25	3¼-9-5.....	739
13 21-25-25	4 1-6-9-5.....	768
14 25-45-25	5-9-5.....	748
15 12½-45-0	2½-9-0.....	483
16 12½-45-10	2½-9-2.....	661
17 12½-45-20	2½-9-4.....	770
18 12½-45-25	2½-9-5.....	849
19 12½-45-30	2½-9-6.....	856
20 12½-45-40	2½-9-8.....	915
21 12½-45-50	2½-9-10.....	956

To supplement the triangle fertilizer tests, a series of plots are being included in the cotton fertilizer work to determine more definitely the ratio of the fertilizer elements best suited to cotton. The plan of this series of tests revolves around the 2½-9-5 recommendation. The phosphoric acid application is varied from 0 through 14 per cent while the nitrogen and potash remain 2½ per cent and 5 per cent respectively on plots one through seven. In the second series the nitrogen application is varied from 0 through 5 per cent on plots nine through fourteen. In the third series potash is varied from 0 through 10 per cent on plots fifteen through twenty-one. As will be observed only one element is varied in each series outlined. This group of plots is being used to check the results of the triangle experiment in which there are always two elements varying.

Source of Nitrogen—Nitrate of soda containing 15% nitrogen.

Source of Phosphorus—Superphosphate containing 16% phosphoric acid.

Source of Potash—Muriate of potash containing 50% potash.

Date of applying fertilizer in relation to planting date—10 to 14 days before planting.

Average planting date—About April 1.

Variety used each year—Petty's Toole.

Method of applying fertilizer in relation to the bed—Applied to furrow and bedded on. Fertilizer about 3 inches below seed.

Size of Plots—1/40 acre. **No. of replications**—Two.

Width of Rows—3.3 feet.

The experiment has not been run continuously on the same land.

Boll weevil Control measures used—Mopped once each year using about 2 pounds calcium arsenate per acre.

Reference: Georgia Coastal Plain Experiment Station Bulletin 13, page 6, 14 and 16, table 5, "Cotton Production in the Coastal Plain of Georgia," Tifton, Georgia.

XIV

Table 13. Cotton Fertilizer Formula Test on Tifton Sandy Loam, Tifton, Georgia
(600 Pounds Fertilizer Per Acre)

Fertilizer Per Acre		Yield in Pounds Seed Cotton Per Acre				
N-P-K	Equivalent to 600 Lbs. of	1929	1930	1931	1932	1933
Phosphoric Acid Series						
15-0-30	2 1/2-0-5	785	522	1408	761	1369
15-24-3	2 1/2-4-5	845	592	1307	828	1602
15-54-30	2 1/2-9-5	995	638	1186	890	1620
15-72-30	2 1/2-12-5	1060	652	1225	1017	1549
Nitrogen Series						
0-54-30	0-9-5	575	456	1179	738	1456
8 1/2-54-30	1 3/8-9-5	870	607	1268	1013	1712
12-54-30	2 1/2-9-5	965	633	1361	967	1606
16 2/3-54-30	3 1/4-9-5	830	653	1285	908	1465
21-54-30	3 1-6-9-5	970	661	1370	975	1764
25-54-30	5-9-5	1040	657	1480	936	1606
Potash Series						
15-54-0	2 1/2-9-0	420	316	957	431	1065
15-54-12	2 1/2-9-2	705	413	1166	684	1205
15-54-24	2 1/2-9-4	770	502	1240	772	1660
15-54-30	2 1/2-9-5	960	571	1165	919	1536
15-54-36	2 1/2-9-6	975	622	1420	842	1768
15-54-48	2 1/2-9-8	1070	734	1371	1099	1672
15-54-60	2 1/2-9-10	1035	778	1518	1002	1598
0-0-0	None	325	267	848	248	1065

The cotton work at Georgia Experiment Station has been largely on a typical Tifton sandy loam with work also being done on a light phase of Tifton sandy loam which very closely resembles Norfolk sandy loam. The results of this work, therefore, should be applicable to both Tifton and Norfolk soil types.

Source of Nitrogen—Nitrate of soda containing 15% nitrogen.

Source of Phosphorus—Superphosphate containing 16% phosphoric acid.

Source of Potash—Muriate containing 50% potassium.

Date of applying fertilizer in relation to planting date—10 to 14 days before planting.

Average planting date—April 1.

Variety used each year—Petty's Toole.

How was fertilizer applied in relation to the bed—Applied to furrow bedded on Fertilizer about 3 inches below seed.

Size of Plots—1/40 acre. No. of replications—Two.

Width of Rows—3.3 feet.

The experiment has not been run continuously on the same land.

During what years have cover crops been grown on this land—None.

Were boll weevil control measures used—Yes. Number of applications and number pounds per acre per application each year—About 2 pounds calcium arsenate per acre. Mopped on.

XV

Table 17. Test on Rate of Application of Nitrate of Soda on Cotton on Orangeburg Sandy Loam In South Carolina

Each plot except no fertilizer received 400 pounds superphosphate and 75 pounds Muriate of Potash at planting time.

	F. L. Knotts Farm		
	1929	1930	2 Yr. Av.
No fertilizer ..	680	550	615
No Nitrate of Soda* ..*	630	770	700
100 Pounds at Planting.....	870	1100	985
(100 pounds at planting			
(100 pounds at chopping.....	1280	1320	1300
(100 pounds at planting			
(200 pounds at chopping.....	1380	1470	1425
(100 pounds at planting			
(300 pounds at chopping.....	1490	1300	1395
(100 pounds at planting			
(100 pounds at chopping.....	1470	1350	1410
(200 pounds 3 weeks after chopping			

* Average of three check plots.

The F. L. Knotts farm is in Orangeburg county which is in about the same latitude as Clay, Webster, Montgomery, Leflore and Sunflower counties, Mississippi.

The most noticeable feature of these results is the comparatively low yields secured from the application of all the sodium nitrate under the crop. This indicates that there must have been considerable leaching of the readily available nitrogen before the young plants were far enough advanced to take it up.

Reference: South Carolina Bulletin 283, page 6, Tables 3 and 4, "Experiments on Time and Rate of applying Sodium Nitrate", April 1932, Clemson College, S. C.

For other experiments showing amounts of nitrogen, applied per acre see table 17.

LOW ANALYSIS VERSUS HIGH ANALYSIS FERTILIZER FOR COTTON

According to the production of cotton per acre, which is the more economical, high-analysis or low-analysis fertilizers?

- a. Which produces more cotton per acre?
- b. Which costs more for a given amount of plant food per acre when
 - (1) home mixed?
 - (2) when bought ready-mixed?
- c. Which requires less labor for hauling and applying?
- d. When figured according to Form 1, which shows a higher cash income per acre.

I

In the past, fertilizers have been sold on the basis of their content of nitrogen, phosphoric acid, and potash. Studies have been shown, however, that the value of fertilizer may be influenced by its content of elements other than nitrogen, phosphorus, and potassium or by the residual effect on the soil. Most of the high-analysis materials are physiologically acid. The soils of Alabama are typical sandy loam with an acid reaction and a low calcium content. The low grade fertilizers which have been largely used in the past usually contained calcium, sulfur, and small quantities of magnesium. As the plant nutrient content of the fertilizers is increased, the content of so-called impurities must obviously decrease.

Several high-grade materials such as Ammo-Phos A and B which contain little calcium have been placed on the market. A number of questions have been raised as to their relative efficiency as compared with low-grade materials.

It was the purpose of this study to compare the efficiency of a commonly used fertilizer mixture (superphosphate, ammonium sulfate, sodium nitrate, and muriate of potash) with a mixture (Ammo-Phos A and B and muriate of potash) which had a much higher analysis; these were compared with and without limestone.

Table 18. The Average Yield, Pounds Per Acre, of Seed Cotton on Coastal Plain Soils from Low—and High—Analysis Fertilizers in Alabama 1930-31

Plot No.	Fertilizer Treatment Before Planting	Fertilizer Pounds Per Acre			N-P-K Side Dressing	Total	Coastal Plain 56 Tests Av. Yield Seed Cotton Lbs. $\frac{1}{1,124}$
		Side Dressing	Before Planting				
1	400 Superphosphate	137 Sod. Nitrate	7 $\frac{1}{2}$ -64-37 $\frac{1}{2}$	21.9-0-0	29 $\frac{1}{2}$ -64-37 $\frac{1}{2}$	$\frac{1}{1,124}$	
	36 Ammonium Sulfate						
	75 Muriate of Potash						
2	85 Ammo-Phos A	None	29 $\frac{1}{2}$ -64-37 $\frac{1}{2}$	None	29 $\frac{1}{2}$ -64-37 $\frac{1}{2}$	1,016	
	125 Ammo-Phos B						
	75 Muriate of Potash						
3	85 Ammo-Phos A	125 Ammo-Phos B;	9 $\frac{1}{2}$ -39-37 $\frac{1}{2}$	20-25-0	29 $\frac{1}{2}$ -64-37 $\frac{1}{2}$	$\frac{1}{1,053}$	
	75 Muriate of Potash						
	400 Superphosphate						
5	36 Ammonium Sulfate	137 Sodium Nit.	7 $\frac{1}{2}$ -64-37 $\frac{1}{2}$ and lime	21.4-0-0	29.4-64-37 $\frac{1}{2}$ and lime	1,105	
	75 Muriate of Potash						
	116 Limestone						
6	85 Ammo-Phos A	None	29 $\frac{1}{2}$ -64-37 $\frac{1}{2}$ and lime	None	29 $\frac{1}{2}$ -64-37 $\frac{1}{2}$ and lime	1,054	
	125 Ammo-Phos B						
	75 Muriate of Potash						
7	116 Limestone	125 Ammo-Phos B	9 $\frac{1}{2}$ -39-37 $\frac{1}{2}$ and lime	20-25-0	29 $\frac{1}{2}$ -64-37 $\frac{1}{2}$ and lime	1,075	
	85 Ammo-Phos A						
	75 Muriate of Potash						
	116 Limestone						

1/ Average of duplicate plots.

Uniform areas of land were selected in various sections and on several of the important soil types of Alabama. These areas were divided into ten 1/20 acre plots. Limestone at the rate of 116 pounds per acre was mixed with the fertilizer and used on one-half of each area. This amount of limestone was necessary to neutralize the acidity developed by the Ammo-Phos applications. These were conducted during 1930 and 1931.

In most cases the initial fertilizer application was made by hand and mixed with the soil from 5 to 10 days before planting the cotton. For the side application the fertilizer was placed in a shallow furrow near the plants and was covered immediately. This application was made, in most cases, after the cotton was thinned and before the first cultivation.

Analysis of Ammo-Phos A—11% Nitrogen, 46% Phosphoric Acid.

Analysis of Ammo-Phos B—16% Nitrogen, 20% Phosphoric Acid.

Calcium content of Limestone—High Lime, no analysis made.

Source of Phosphorus—Superphosphate containing 16% Phosphoric Acid.

Width of Rows—Various.

The experiment has not been run continuously on the same land.

Reference: Alabama Bulletin 238, pages 17, 19 and 20, table 6, "Experiments With Commercial Nitrogenous Fertilizers," Auburn, Alabama.

II

Table 19. High Analyses Fertilizer Test on Tifton Sandy Loam, Tifton, Ga.

Fertilizer Per Acre			Yield in Pounds Seed Cotton Per Acre						
Pounds N-P-K	Rate (Lbs.)	Formula	1926	1927	1928	1929	4 Yr. Av. 1926-1929	6 Yr. Av. 1926-1931	
½-45-25	500	2½-9-5	834	664	610	635	686	735	
½-45-25	375	3½-12-6.6	686	605	690	.....	660**	.....	
½-45-25	300	4½-15-8.3	597	550	510	747	601	702	
½-45-25	250	5-18-10	745	607	620	812	696	797	
½-45-25	187 ½	6¾-24-13.3	638	531	650	740	640	737	
½-45-25	150	8½-30-16.6	659	514	670	582	606	692	
-90-50	1000	2½-9-5	1070	864	900	967	950	1017	
-90-50	750	3½-12-6.6	1024	827	900	.....	917**	.....	
-90-50	600	4½-15-8.3	841	806	980	810	859	987	
-90-50	500	5-18-10	1021	861	960	857	925	1003	
-90-50	375	6¾-24-13.3	1000	751	960	702	853	943	
-90-50	300	8½-30-16.6	948	775	905	580	802	886	

Three-year average.

Fertilizers for this test were made from the following materials:

Superphosphate 16%

Nitrate of Soda 15%

Triple superphosphate 44%

Urea 45.8% N

Nitrophoska 15-48-15

Muriate 50% Potash.

Manure Salts 20% Potash

Time of applying Fertilizer in relation to planting date—10 to 14 days before planting.

Average planting date—April 1.

Variety used each year—Petty's Toole.

How was Fertilizer applied in relation to the bed—Applied to furrow bedded on.

Fertilizer about 3 inches below seed.

Size of Plots—1/20 acre. No. of replications—Two.

The experiment has not been run continuously on the same land.

Will weevil control measures used—Mopped once each year using about 2 pounds

Calcium Arsenate per acre.

Reference: Georgia Coastal Plain Experiment Station Bulletin 13, page 17, table 7, "Cotton Production in the Coastal Plain of Georgia," Tifton, and Georgia Coastal Plains Experiment Station Bulletin 21, page 17, table 9, "Thirteenth Annual Report," Georgia, June 1933.

III

Table 20. Yields of Cotton From Ordinary-Analysis Fertilizer and Concentrated Fertilizer on Ruston Sandy Loam, Fayetteville, N. C.

		Each Plot, Except Checks, Received 48-64-64 Lbs. N-P-K Per Acre				
Fertilizer Analysis	Rate Per Acre Lbs.	Source of Fertilizer Materials	Yield in Pounds Seed Cotton Per Acre			
N-P-K			1931	1932	1933	Average
			Lbs.	Lbs.	Lbs.	Lbs.
6-8-8	800	Superphosphate, sodium nit. and potassium sulphate.....	2100	1437	2150	1896
6-8-8	800	Superphosphate, sodium nitrate cottonseed meal and potassium sulphate*....	2025	1538	2125	1896
12-16-16	400	Ammonium phosphate, sodium nitrate, and potassium sulphate.....	1836	1324	1603	1588
6-8-8	800	Superphosphate, ammonium sulphate and potassium sulphate	1975	1387	1788	1717
6-8-8	800	Superphosphate, ammonium sulphate, cottonseed meal and potassium sulphate**....	2075	1537	1862	1825
12-16-16	400	Ammonium phosphate, ammonium sulphate, and potassium sulphate.....	1675	1292	1557	1508
6-8-8	800	Superphosphate, urea and potassium sulphate	1975	1437	1762	1725
6-8-8	800	Superphosphate, urea, cottonseed meal and potassium sulphate***	2135	1335	2012	1827
12-16-16	400	Ammonium phosphate, urea, and potassium sulphate	1812	1268	1200	1427
No Fertilizer			1025	762	870	886

The experiments on Ruston sandy loam included a study of sodium nitrate ammonium sulphate, and urea as sources of nitrogen in concentrated fertilizer with ammonium phosphate and potassium sulphate. Fertilizers were prepared in double strength, analyzing 12 percent of ammonia, 16 percent of phosphoric acid and 16 percent of potash, and compared with a 6-8-8 fertilizer contained superphosphate, nitrogen, and potassium sulphate. The results are given in Table 20.

* Nitrogen derived 65% sodium nitrate and 35% from cottonseed meal.

** Nitrogen derived 65% from ammonium sulphate and 35% from cottonseed meal.

*** Nitrogen derived 65% from urea and 35% cottonseed meal.

To compare the nitrogen sources in table 20 compare plots 1, 4, and 7. the plots 2, 5, and 8; then plots 3, 6, and 9.

Analysis of Ammonium Phosphate—11% P₂O₅.

Date of applying fertilizer in relation to planting date—7 to 10 days before planting.

Average planting date—April 20.

Variety used each year—Coker's Farm Relief.

Method of applying fertilizer in relation to the bed—Applied in drill, stirred and covered so that when seed are planted fertilizer will be about 3 inches below seed.

Size of Plots—1/25 acre. No. of replications—2.

Width of Rows—3½ feet.

The experiment has been run continuously on the same land, each plot following itself each year of the experiment.

Cover Crops—None have been grown during the progress of the experiment.

Boll weevil control measure used—None except that early shedded squares were picked up.

Before the experiment was begun, the average yield of corn per acre without fertilizer was—50 bushels.

Other remarks that may help in interpreting the data—This field was in corn and soybeans the year before the experiment was begun. All except the silt

shucked corn was turned under for soil improvement. The growth of soybeans was about 3,000 pounds per acre.

Preceding the inauguration of the experiment the field had grown cotton in rotation with corn interplanted with soybeans. The vegetation produced by the soybeans was plowed under in the fall for green manure. By this practice the soil had been maintained at a high level of fertility, and large yields of cotton were secured. The year preceding the inauguration of the experiment, the field was in corn and soybeans and a mass of vegetation from the soybean vines was turned under late in the fall. Cotton was grown continuously in the experiment for 3 years, each plot receiving identical fertilizer treatments each year, and no vegetation except cotton stalks was grown or turned under during the 3 year period.

Reference: United States Department of Agriculture, Technical Bulletin 452, "Experiments with Nitrogen Fertilizers on Cotton Soils." Page 26, 1934.

For other experiments on high-analysis versus low-analysis fertilizers for cotton see Table 21.

FACTORY-MIXED VERSUS HOME-MIXED FERTILIZER

Which is more economical, factory-mixed or home-mixed fertilizers?

- Which produces more cotton per acre when equal amounts of plant nutrients per acre are used?
- Which costs less per unit of plant nutrients.
- How well does the mixing of fertilizer fit into the labor distribution of your farm?

I

Table 21. Factory vs. Home Mixed Fertilizer on Olivier Silt Loam at Raymond Branch Experiment Station, Raymond, Mississippi
Each Plot Received 32-64-32 Lbs. N-P-K Per Acre

Fertilizer Used	Increase Over No Fertilizer in Pounds Seed Cotton Per Acre				
800 Lbs. 4-8-4 or 200 Lbs. 15-30-15 Per Acre	1929	1930	1931	1933	4 Year Average
Jackson 4-8-4	281	343	307	148	270
Home Mixed 4-8-4 (Superphosphate)	392	283	343	509	382
Nitro-phoska 15-30-15	246	295	187	286	258
Meridian 4-8-4	304	375	313	305	324
Home Mixed 4-8-4 (Rhums)	256	370	237	391	313
Plant Food Canton 4-8-4	284	473	207	299	316
No Fertilizer (Av. 3 Plots)	1192	1344	1395	1629	1390

Discontinued after 1933.

Soil Type—Olivier silt loam.

Date of applying Fertilizer—1929, May 1; 1930, April 17; 1931, May 2, 1933, May 10.

Date of planting cotton—1929, May 1; 1930, April 22; 1931, May 4. 1933, May 12.

Method of preparing seed bed—Land double disked, plowed broadcast, harrowed, laid off in rows with middlebreaker, fertilizer applied by hand in water furrow and bedded on with middlebreaker. Beds harrowed and planted.

Size of Plots—1/20 acre, repeated 5 times.

Width of Rows—3½ feet wide.

Variety of Cotton—1929-31 Lone Star 65; 1933, Starfos*.

1929—Very cool weather followed planting, the temperature going as low as 40 degrees F.

*Starfos is a cross between Lone Star 65 and Delfos 6102.

II

Table 22. Factory Mixed vs. Home Mixed Fertilizer for Cotton on Ruston Fine Sandy Loam at South Mississippi Experiment Station, Poplarville, Miss.

All Applications At The Rate of 600 Pounds Per Acre

N-P-K Applied Per Acre			Lbs. Seed Cotton Per Acre Increase Over					No Fert.
Factory Mixed	Home Mixed	Analysis	1927	1928	1929	1930	1931	5 Year Average
24-48-24		4-8-4 ..	516	183	796	317	847	532
	24-48-24	4-8-4 ..	449	116	888	393	874	544
24-48-24		4-8-4* ..	377	86	878	401	764	501
No Fertilizer			648	716	967	560	393	656

* 5-8-4 in 1929 and 1928. (30-48-24 Lbs. N-P-K Per Acre)

Soil Type—Ruston fine sandy loam.

Planting date—1927, April 4; 1928, May 4; 1929, April 23, 1930, about April 1. 1931, about April 1.

Time of applying Fertilizer—1927, March 29; 1928, March 28; 1929, April 13; 1930, 10 days prior to planting. 1931 10 days prior to planting.

Width of Rows—3½ feet.

Spacing of plants in drill—Hoe width.

Size of Plots—1/20 Acre.

Variety of Cotton—1927, Lone Star 65; 1928, Cleveland 54; 1929-31, D. & P. L. 5242A-310-46.

During what years have cover crops been grown on these plots—1930 and 1931.

Kind of Cover Crops—Oats

NITROGEN SOURCES FOR COTTON

What is the most economical source of nitrogen on your soil type, considering cost per pound of nitrogen and yield per acre? How many of the sources are available in your community?

For a definition of organic and inorganic nitrogen sources see explanation above table 38.)

I

Field Experiments With Different Sources of Nitrogen in Alabama

The different sources of nitrogen used for the full five-year period were sodium nitrate, ammonium sulfate, mixture of Ammo-Phos A and sodium nitrate, Leunasal-peter, urea, and cottonseed meal. Calcium nitrate was used in the experiments conducted in 1927 and 1928, and Calnitro and Calurea were included in 1929, 1930, and 1931. Each plot received 64 pounds of phosphoric acid and 25 pounds of potash per acre. Each nitrogen-treated plot received 30 pounds of nitrogen per acre. Due to the fact that a fertilizer carrying the above quantities of nitrogen and phosphoric acid could not be made from Ammo-Phos A alone, it was necessary to supplement the Ammo-Phos A with another source of nitrogen. Consequently, all of the phosphoric acid and one-half of the nitrogen for this plot were from Ammo-Phos A and the remaining one-half of the nitrogen was from sodium nitrate. The cottonseed meal used in these experiments contained seven per cent of ammonia. It was used on the basis of 5.76 per cent nitrogen, 2.5 per cent phosphoric acid, and 1.5 per cent potash. All of the phosphoric acid except that in Ammo-Phos A and in cottonseed meal was from superphosphate. All potash except the small quantity in cottonseed meal was from muriate of potash.

The usual plan of applying the fertilizers was to use one-fourth of the nitrogen, all of the phosphoric acid, and all of the potash at planting time and to apply the remaining three-fourths of the nitrogen just prior to the first cultivation after the cotton was thinned. Exceptions to this general scheme were made in the cases of cottonseed meal and Ammo-Phos A. On the cottonseed meal plot, all fertilizers were mixed and applied immediately before the seed were planted. On the Ammo-Phos A plot, this material was mixed with the muriate of potash and the mixture applied immediately before the planting, whereas the sodium nitrate used to bring the nitrogen application to 30 pounds per acre was applied just prior to the first cultivation after the cotton was thinned.

Table 23. Average Yield of Seed Cotton, Pounds Per Acre, on Various Soil Regions Of Alabama From Different Sources of Nitrogen, 1927-31

All plots received 64 pounds phosphoric acid and 25 pounds potash per acre. All except check plots received 30 pounds of nitrogen.

Plot No.	Source of Nitrogen <u>1/</u>	Oktibbeha Soil 15 Expts.	Greenville Soil 34 Expts	Norfolk Soil 57 Expts.
1	No nitrogen	645	583	634
3	Sodium nitrate	854	948	949
4	Ammonium sulfate	791	936	891
6	No nitrogen	629	569	623
7	Ammo-Phos A <u>2/</u>	858	915	838
8	Leunasalpter ..	777	907	890
9	Urea ..	808	905	894
10	Cottonseed meal	654	809	834
11	No nitrogen	626	570	629
	Av. no nitrogen plots.....	633	574	629

1/ All plots received 64 pounds of phosphoric acid and 25 pounds of potash and all nitrogen plots received 30 pounds of nitrogen per acre.

2/ One-half of the nitrogen from Ammo-Phos A and one-half from sodium nitrate.

Greenville Soil Group: All of the experiments on red soils with red subsoil and on gray soils with red subsoil of the Coastal region have been grouped into the Greenville soil group. Included in this group will be found all of the experiments conducted on Greenville, Amite, Cahaba, and Orangeburg soil series. Of these experiments, 12 were on Greenville, 13 on Orangeburg, 7 on Cahaba and 2 on Amite soils.

Norfolk Soil Group: All of the experiments conducted on Norfolk and on Ruston soils have been placed in the Norfolk soil group. This group includes all of the upland soils of the Coastal Plain Region which have a gray soil with yellow subsoil or gray soil with reddish-yellow subsoil.

Reference: Alabama Bulletin 238, page 8, table 1, "Experiments With Commercial Nitrogenous Fertilizers", 1932, Auburn, Alabama.

Table 24. Effect of Air-Derived Nitrogen Compounds In Mixed Fertilizers For Cotton Production
All Fertilizer Applied Before Planting

Location	Wilson, N. C.	Weldon, N. C.	Newbern, N. C.	Florence, S. C.	Bennettsville, S. C.
Soil Type	Malboro Sandy Loam	Greenville Sandy Loam	Portsmouth Sandy Loam	Pee Dee Experiment Station (c) Norfolk Fine Sandy Loam	Malboro Sandy Loam
Lbs. N-P-K Per A.	45-72-36	60-96-48	45-72-36	45-72-36	45-72-36
Equivalent to	900 Lbs. 5-8-4	1200 Lbs. 5-8-4	900 Lbs. 5-8-4	900 Lbs. 5-8-4	900 Lbs. 5-8-4
Sodium	1926	1927	1921	1921	1921
Sodium Nitrate	1617	1624	1620	1620	1620
Ammonium Sulphate	1755	1392	1573	2080	2080
Ammonium Nitrate	1276	1580	1428	2130	1900
Ammonium Chloride	1291	1566	1428	1410	1420
Ammonium Chloride (a)	1247	1566	1407	1250	1240
Ammonium Phosphate (b)	1291	1682	1486	1880	1820
Urea	1320	1595	1457	1850	1960
Leuna-Sulphate	1581	1754	1667	2090	1640
No Fertilizer	827	783	805	860	540

Phosphoric acid was derived from superphosphate; potash from sulphate of potash except where noted.

(a) Potash in this fertilizer from muriate of potash.

(b) Phosphoric acid in this fertilizer from ammonium phosphate (48% phosphoric acid and 12% nitrogen). There was an excess of phosphoric acid. The experiments with the nitrogen materials at the Pee Dee Station made with cotton and corn grown in rotation and are a part of a large experiment with general fertilizer materials and fertilizer ratios. Dixie Triumph Wilt Resistant cotton was grown each year. The same fertilizers were applied to the corn at the rate of 450 pounds per acre.

Reference: United States Department of Agriculture Technical Bulletin 452, pages 4, 5, and 6, tables 1 and 2, "Experiment with Nitrogen Fertilizers on Cotton Soils," Washington, D. C., October, 1934.
South Carolina Bulletin 227, pages 7 to 11, tables 1 and 3 "Sources of Ammonia," Clemson College, South Carolina, May 1926.
North Carolina Bulletin 266, pages 10 to 15, tables 1, 4 and 5, "Effects of Synthetic Nitrogen and Concentrated Fertilizers on Cotton and Sweet Potatoes."

Conditions for 5-year test at Pee Dee Station:

Kind of Sodium Nitrate—Chilean.

Date of applying fertilizer in relation to planting date—10 days in advance of planting.

Average planting date—April 20. **Earliest planting date during the test**—April 18.

Latest Planting date—April 25.

Variety used each year—Cleveland.

Method of applying fertilizer in relation to the bed—In the furrow below the seed.

Size of Plots—1/20 acre. **No. of replications**—Two.

Width of Rows—4 feet.

Cover Crops—Every second year cowpeas have been grown on this land.

Boll weevil control measures used—Three applications of poison were made.

Before the experiment was begun the average yield of corn per acre without fertilizer was 25 bushels. Yield of seed cotton without fertilizer was 756 pounds (average).

III

Table 25. Winter Legume and Cotton Test on Olivier Silt Loam at Raymond Branch Experiment Station, Raymond, Mississippi

Cover Crop	Fertilizer Per Acre		Actual Yield Per Acre in Pounds Seed						
	Pounds	Equiv. to	Cotton						
	N-P-K	600 Lbs. of:	1929	1930	1931	1932	1933	1934	1929-1934
None	36-48-24	6-8-4	1420	1368	1245	946	1418	1227	1271
Hairy Vetch	0-48-24	0-8-4	1133	1439	1037	839	1368	1143	1160
Monantha Vetch	0-48-24	0-8-4	1265	1258	1112	777	984	758	1026
None ..	0-48-24	0-8-4	1061	1207	783	576	919	531	846
None ..	36-48-24	6-8-4	1613	1665	1425	1046	1569	1341	1443
Burr Clover	0-48-24	0-8-4	965	1165	1110	816	955	570	930
Crimson Clover	0-48-24	0-8-4	942	1069	744	785	951	684	862
Austrian Peas	0-48-24	0-8-4	1021	1027	863	854	930	860	926
None ..	36-48-24	6-8-4	1267	1368	1279	944	1279	1123	1208

Cover crop turned under—1929, April 1; 1930, April 15; 1931, April 15; 1933, April 15; 1934, April 15.

Fertilizer applied—1929, April 15; 1930, April 30; 1931, April 27; 1933, May 9. 1934, April 20.

Cotton planted—1929, April 18; 1930, May 1; 1931, April 28. 1933, May 9; 1934, April 20.

Variety of Cotton—1929-31, Lone Star 168; 1932-34, Lone Star 561.

Size of Plots—1/20 acre. Between plots was a skip row. Plots repeated four times.

Land History—In the fall of 1925 a good cotton year, this piece of land produced an average of 300 pounds seed cotton per acre. Oats, vetch and burr clover were planted in 1925 and turned under. In the spring of 1926 velvet beans were planted over an application of 400 pounds per acre of equal parts, cottonseed meal and superphosphate. In the fall of 1926 the velvet beans were turned under and land was planted to oats, vetch and volunteer burr clover. In the spring of 1927 the cover crop was turned under and soybeans were planted in rows and cut for hay. In the fall of 1927 the land was planted to oats and vetch and cut for hay in the spring of 1928. This was followed with soybeans and they were turned under. The above test was begun in the fall of 1928.

Reference: Record cards from Raymond Branch Experiment Station, Raymond, Mississippi.

Table 26. Cotton Nitrogen Sources Test on Olivier Silt Loam at Raymond, Mississippi

Pounds Material Applied To The Acre	Increase Over No Nitrogen In Pounds Seed Cotton Per Acre									
	1925	1926	1927	1928	1929	1930	1931*	1933	1934	9 Year* Average
150 Nitrate of Soda.....	319	384	143	250	196	114	352	167	423	261
112.5 Ammonia Sulphate.....	271	268	168	253	141	190	347	357	315	257
86.5 Leunaspalter .....	.....	390	168	170	182	335	364	.....	.....	.....
105 Calcium Cyanamid	345	42	186	177	102	421	347	271	379	252
150 Calcium Nitrate	322	248	175	398	253	223	404	355	.....	279 1/
48.9 Urea	365	231	160	358	294	304	438	309	103	285
Actual Yield with No Nitrogen.....	1482	1633	1459	871	1188	1687	968	1768	998	1339

* Test discontinued in 1932 due to a lack of funds with which to buy fertilizer.

1 / 8 years only.

— Each plot except check received 22.5 pounds available nitrogen per acre.

1925—A general application of 300 pounds superphosphate and 150 pounds sulphate of potash per acre was made to each plot including checks. (48 Lbs. P. and 75 Lbs. K.)

1927—All plots received 300 pounds 16% superphosphate and 40 pounds 48% muriate of potash per acre. (48 Lbs. P. and 20 Lbs. K.)

1928—All plots received 600 pounds 0-8-4 fertilizer per acre. (48 Lbs. P. and 24 Lbs. K.)

1929—All plots, including checks were fertilized with 300 pounds superphosphate and 50 pounds muriate of potash per acre. (48 Lbs. P. and 25 Lbs. K.)

Phosphorus fertilizer applied—16 and 20% superphosphate. Potash fertilizer applied—Muriate of potash.

Date of applying fertilizer—1926, April 12; 1927, April 17; 1928, April 20. 1929, April 12; 1930, April 16; 1931, April 13; 1933, April 28; 1934, April 13.

Date of planting cotton—1925, May 14; 1926, April 17; 1927, April 20; 1928, April 21 (stand injured to average extent by frost on April 28); 1929, April 18; 1930, April 23; 1931, April 17; 1933, May 3; 1934, April 20.

Variety of Cotton used—1925-31, Lone Star 65; 1933-34 Starfos (Lone Star 65x Delfos 6102).

Size of Plot—1/20 Acre. No. of replications—Three.

Reference: Record cards from Raymond Branch Experiment Station, Raymond, Mississippi.

V

Table 27. New Nitrogen Sources Test With Cotton On Oliver Silt Loam At Raymond, Mississippi

Nitrogen Sources	Increase over no Nitrogen in Lbs of Seed Cotton Per Acre				
48-96-48 Lbs. N-P-K or 800 Lbs. 6-12-6 per acre from:	1929	1930	1931*	1933	4 Year Average
Nitrate of Soda	276	411	243	723	413
Sulphate of Ammonia	129	817	154	598	299
40% Sul. of Ammonia 60% Nitrate of Soda	203	313	218	780	378
Arcadian Nitrate of Soda			288	670	
Calcium Nitrate	213	385	191	477	316
Cyanamid ..				784	
Calurea ..	258	419	286		321 ^{1/}
Ammophos ..	-85	156	67	601	185
Leunaspeter ..	139	246			
Cal-Nitro ..	345	342	293	672	413
No Fertilizer ..	-265	-114	-64	36	-102
Actual Yield No Nitrogen	1399	1670	706	1030	1201

* No experiment in 1932 due to lack of funds for purchase of fertilizer.

^{1/} Three year average.

Each plot except check received 48 pounds of available nitrogen per acre. Each plot received 96 pounds phosphoric acid and 48 pounds potash per acre.

Phosphorus fertilizer applied—Superphosphate.

Potash fertilizer applied—Muriate of potash.

Date of applying fertilizer—1929, April 23; 1930, May 3. 1931, May 9; 1932, no work; 1933, May 6.

Date of Planting Cotton—1929, May 1; 1930, May 3; 1931, May 11 and again June 3; 1933, May 8.

Variety Cotton used—1929, Lone Star 163; 1930-31, Lone Star 65; 1933, Lone Star 561.

Size of Plot—1/30 acre, repeated three times.

Width of Rows—3½ feet.

Spacing of Cotton in drill—3 stalks each foot in bunches.

Method of applying fertilizer—Bedded on it.

Reference: Record cards from Raymond Branch Experiment Station, Raymond, Mississippi.

VI

Table 28. Cotton Nitrogen Sources Test on Memphis Silt Loam at The Natchez Branch Experiment Station, Natchez, Mississippi

Source	Lbs. Per Acre	Yield in Pounds of Seed Cotton Per Acre				Average Increase Over No Nitrogen
		1929	1930	1931	Average	
No Fertilizer	.....	481.0	433.0	731.2	548.4	
No Nitrogen	.....	567.0	556.0	671.3	598.1	
Nitrate of Soda	240	1313.0	896.0	1261.1	1156.7	558.6
Calcium Nitrate	240	1239.0	938.0	1559.3	1245.4	647.3
Calurea	106	1139.0	905.0	1198.4	1080.1	482.0
Calcium Cyanamid	171	1060.0	777.0	1257.8	1031.6	433.5
Leunaspeter	138	1023.0	767.0	779.7	856.6	258.4
Cal-Nitro	176	1057.0	892.0	1192.2	1047.0	448.9
Ammonium Sulphate	176		862.0			

All plots, including checks, received 72 pounds phosphoric acid and 36 pounds potash per acre. All plots except checks received 36 pounds nitrogen per acre or a total equivalent of 600 pounds 6-12-6 per acre.

Soil Type—Memphis silt loam.

Width of Rows—40 inches.

Spacing of plants in drill—Approximately 4 plants per foot.

Usual time of planting—About April 15.

Time and method of applying fertilizer—5 to 10 days before planting, spread by hand in drill and covered. Cotton planted over fertilizer.

Variety of Cotton—D. & P. L. No. 4.

No cover crops have been grown on the land since this test was begun. The test was run continuously on the same land for the three years.

Size of Plots—0.6 acre. No. of replications—4.

Boll weevil control measures used—1929, 3 applications, 6 pounds each; 1930, 2 applications, 7 pounds each; 1931, 3 applications, 7 pounds each.

Before the experiment was begun the average yield of corn per acre without fertilizer was 20 bushels. Yield of seed cotton without fertilizer was 800 pounds.

VII

Table 29. Cotton Nitrogen Sources Test On Lintonia Silt Loam At Holly Springs Branch Experiment Station, Holly Springs, Mississippi

	Pounds Seed Cotton Per Acre Increase Over No Nitrogen*											
	1925	1926	1927	1928	1929	1930	1931	1/ 1933	1934*	8 Yr. Av.		
										1925-33	1926-31	1929-31
Nitrate of Soda	247	538	393	482	462	437	647	658	437	483	478	515
Am. Sulphate	202	441	401	479	414	370	667	417	220	424	462	484
Cal. Cyanamid	151	175	405	242	340	345	527	600	222	348	339	404
Cal. Nitrate ..	332	425	503	453	417	450	358				434	408
Urea ..	219	485	634	442								
Calmitro .....	.....	.....	.....	436		381	647					488
Leucanilpeter .....	.....	510	451	423	432	340	794				492	522
No Nitrogen ..	1742	909	466	1008	388	360	190	383		681	553	313

* Increase over no fertilizer instead no nitrogen in 1934. Yield with no fertilizer in 1934, 472 pounds.

1/ 1932 Experiment omitted because of lack of funds with which to buy fertilizer.

Soil Type—Unimproved sandy loam valley land, Lintonia silt loam, until 1929. 1929-31 Shallow phase Memphis silt loam underlain with Wilcox sand. Thin brown loam table land that has been cropped to cotton for more than one-half century with practically no soil improvement methods having been used.

Size of Plots—1/20 acre repeated 3 times.

Width of Rows—3½ feet.

Variety of Cotton—1925-27, Miss. Station Trice; 1928, Lone Star 79; 1933, Stoneville No. 3.

Fertilizer—1925 all plots including the checks had 200 lbs. superphosphate and 50 pounds sulphate of potash per acre. Each nitrogen carrier was applied at such rate as to supply 22.5 pounds available nitrogen per acre. 1926-1930, 400 pounds superphosphate and 67½ pounds sulphate of potash, 30 pounds of available nitrogen. 1929-1934, 36 pounds available nitrogen.

Reference: Annual Reports Holly Springs Branch Experiment Station, Holly Springs, Mississippi, 1925-1934.

VIII

Table 30. Nitrogen Sources Test With Cotton On Houston Clay At West Point, Miss.

24-48-24 Lbs. N-P-K or 600 Pounds 4-8-4 Per Acre Using as Nitrogen Source	1926	1927	1928	1929	1930	1931	1932	7 Year Average
	Increase in Pounds Seed Cotton Over 600 Lbs. 0-8-4 Per Acre							
Nitrate of Soda	58	291	58	236	39	137	253	153.2
Ammonium Sulphate	-10	262	181	234	6	72	247	141.7
								1/
Leunaspeter	33	299	116	180	39	.....	.....	133.3
Calcium Cyanamid ..	27	254	123	255	29	12	199	128.4
Calcium								2/
Nitrate ..	9	184	5	266	68	146	.....	113.1
Urea ..	11	223	94	176	57	108	154	117.6
Yield Per Acre With 600 Lbs. 0-8-4 (0-48-24 Lbs N-P-K)	728	628	365	936	644	435	405	591.6

1/ Five years only.

2/ Six years only.

Soil Type: Houston Clay Loam.

Width of Rows: 3½ feet.

Size of Plots: 1/20 acre run in 3 replications.

Reference:—Mississippi Bulletin 289, table 31, page 24, "Commercial Fertilizers for Cotton, 1925-30, State College, Mississippi."

IX

Table 31. Cotton Nitrogen Sources Test On Ruston Fine Sandy Loam, At Poplarville, Mississippi

600 Lbs. 4-8-4 Per Acre (24-48-24 Lbs. N-P-K) from	Increase Over 600 Lbs. 0-8-4 in Pounds Seed Cotton Per Acre							
	1926	1927	1928	1929	1930	1931	6 Year Av.	
Fish Scrap ..	-40	165	100	453	77	272	171	
Tankage ..	5	128	69	454	92	260	168	
½ F. S. and ½ N. Soda.....	33	223	63	425	70	327	190	
								1/
Calcium Nitrate ..	.....	212	145	495	41	411	261	
½ Tankage and ½ Nitrate Soda.....	85	176	138	475	101	423	233	
Dried Blood ..	.....	.....	.....	627	101	408	.....	
Yield Per Acre with 600 Lbs. 0-8-4.....	993	902	677	1256	788	646	877	

1/ Five year average.

Soil Type—Ruston Fine Sandy Loam. Before the beginning of this test in 1926, this land had been used as pasture. The land has been in cultivation about 75 years.

Date of applying fertilizer—1928, March 29; 1929, April 19; 1930, April 8.

Date of planting Cotton—1928, May 4; 1929, April 20; 1930, April 18.

Variety of Cotton—1928, Cleveland 54; 1929-30, D. & P. L. 5242A-310-46.

Width of Rows—3½ feet.

Spacing of plants in drill—Chopped to hoe with.

Size of Plots—1/20 acre run in three series.

Poison Applied—1928, three applications of Calcium Arsenate; 1929, report indicates that some poison was applied, but the number of applications is not given. The same land was used continuously for the six years of this test, each nitrogen source following itself year after year on the same plots.

Reference: Mississippi Agricultural Experiment Station Bulletin No. 289, Page 25, Table 31, January 1931, "Commercial Fertilizers for Cotton 1925-1930", State College, Miss.

X

**Table 32. Nitrogen Sources Test for Cotton On Ruston Fine Sandy Loam At Poplarville Branch Experiment Station, Poplarville, Mississippi
Boyd Smith Field**

Increase Over 600 Lbs. 0-8-4 In Pounds Seed Cotton Per Acre									
600 Lbs. 6-8-4 Per Acre (36-48-24 Lbs. N-P-K) From	1925	1926	1927	1928	1929	1930	1931	4 Year Average 1928-31	7 Year Average 1925-31
Nitrate of Soda	379	41	262	-21	597	284	513	331	286
Ammonium Sulphate ..	350	94	209	65	411	19	421	229	224
Calcium Cyanamid ..	141	3	328	65	344	89	508	251	211
Calcium Nitrate	334	33	301	30	368	44	345	197	208
Urea ..	309	-22	326	135	256	-11	326	176	188
Cal Urea ..	.....	.....	.....	164	294	22	355	209	.....
Leunaspeter ..	.....	.....	350	64	312	-118	403	165	.....
600 Lbs. 0-8-4	1393	1146	624	500	713	753	458	606	798

Soil Type—Ruston fine sandy loam.

Date of Planting—1925, March 21; 1927, May 4; 1928, May 4; 1929, April 20. 1930, April 17.

Time of Applying Fertilizer—1925, March 21; 1927, March 27; 1928, March 27; 1929, April 6; 1930, March 24.

Width of Rows—Three and one-half feet.

Spacing of Plants in Drill—Chopped to hoe width.

Size of Plots—1/20 acre.

Variety of Cotton—1925, Miss. Station Trice; 1927, Cleveland 54; 1928, Cleveland 54; 1929, D. & P. L. 5242A-310-46.

Oats have been grown on this land each year of the test.

Reference: Annual reports of the station.

XI

Table 33. Yields of Cotton on Ruston Sandy Loam, Fayetteville, N. C., From Fertilizer containing Nitrogen From Different Sources and Varing Percentages of Mineral, Synthetic, and Organic Nitrogen.

(Fertilizer applied at rate of 800 pounds per acre; source of fertilizer ingredients: Nitrogen as noted, phosphoric acid from superphosphate, potash from potassium chloride). Each plot received 64 lbs. each of phosphoric acid and potash, while each plot except checks received 48 lbs. Nitrogen per acre.

Source of Nitrogen in -6-8-8 Fertilizer	Yield in Pounds Seed Cotton Per Acre.				Average % open at first picking
	1931	1932	1933	Average Yield	
No Nitrogen	2370	1325	1425	1707	76.3
25% from Sodium Nitrate					
75% from Cottonseed Meal	2100	1350	2001	1817	74.0
50% from Sodium Nitrate					
50% from Cottonseed Meal	2100	1387	2050	1846	67.0
65% from Sodium Nitrate					
35% from Cottonseed Meal	2025	1538	2125	1896	65.6
80% from Sodium Nitrate					
20% from Cottonseed Meal	2225	1540	2219	1995	68.3
90% from Sodium Nitrate					
10% from Cottonseed Meal	2090	1537	2100	1909	64.3
100% from Sodium Nitrate					
0% from Cottonseed Meal	2100	1437	2150	1896	70.0
Average of Sodium Nitrate Series ..	2107	1465	2108	.....	.....
No Nitrogen ..	2325	1362	1400	1696	78.6
25% from Ammonium Sulphate					
75% from Cottonseed Meal	2100	1412	1802	1771	73.3
50% from Ammonium Sulphate					
50% from Cottonseed Meal	2100	1487	1891	1826	74.6
65% from Ammonium Sulphate					
35% from Cottonseed Meal	2075	1537	1862	1825	70.3
80% from Ammonium Sulphate					
20% from Cottonseed Meal	2175	1562	1962	1900	68.3
90% from Ammonium Sulphate					
10% from Cottonseed Meal	2110	1537	1825	1824	68.6
100% from Ammonium Sulphate					
0% from Cottonseed Meal	1975	1387	1788	1717	71.3
Average of Ammonium Sulphate Series ..	2089	1487	1855	.....	.....
No Nitrogen ..	2240	1325	1438	1668	75.3
25% from Urea					
75% from Cottonseed Meal	2000	1437	1895	1777	78.6
50% from Urea					
50% from Cottonseed Meal	1925	1524	1987	1812	73.0
65% from Urea					
35% from Cottonseed Meal	2135	1335	2012	1827	72.3
80% from Urea					
20% from Cottonseed Meal	2060	1362	1875	1766	70.3
90% from Urea					
10% from Cottonseed Meal	2025	1500	1880	1802	72.0
100% from Urea					
0% from Cottonseed Meal	1975	1437	1762	1725	73.3
Average from Urea	2019	1403	1902	.....	.....

Preceding the inauguration of the experiment the field had grown cotton in rotation with corn interplanted with soybeans. The vegetation produced by the soybeans was plowed under in the fall for green manure. By this practice the soil had been maintained at high level of fertility, and large yields of cotton were secured. The year preceding the inauguration of the experiment, the field was in corn and soybeans and a mass of vegetation from the soybean vines was turned under late in the fall. Cotton was grown continuously in the experiment for 3 years, each plot receiving identical fertilizer treatments each year, and no vegetation except cotton stalks was grown or turned under during the 3 year period.

In this experiment 800 pounds an acre of a 6-8-8 or 0-8-8 fertilizer were applied before planting.

In 1931, when cotton followed corn and soybeans, the no-nitrogen fertilizers gave larger yields than did any of the fertilizer mixtures containing nitrogen, re-

gardless of the sources of nitrogen. In 1932, the second year after corn and soybeans were grown, the yields from the fertilizers containing nitrogen were greater than from the no-nitrogen fertilizers, but the differences were not wide. In 1932, after cotton had grown 2 years, in succession without turning under green-manure crops, there was a decidedly increased yield from the nitrogen fertilizers over the no-nitrogen fertilizers.

Source of Phosphorus—Superphosphate containing 16% phosphoric acid.

Source of Potash—Sulphate of potash containing 48% potash.

Date of applying fertilizer in relation to planting date—7 to 10 days before planting.

Average planting date—April 20.

Variety used each year—Coker's Farm Relief.

Method of applying fertilizer in relation to the bed—Applied in drill, stirred and covered so that when seed are planted fertilizer will be about 3 inches below seed.

Size of Plots—1/25 acre. **No. of replications**—Two.

Width of Rows—3½ feet.

The experiment has been run continuously on the same land, each plot following itself each year of the experiment.

Cover Crops—None have been grown on the land during the progress of the experiment.

Boll Weevil Control Measures Used—None except that early shedded squares were picked up.

Before the experiment was begun the average yield of corn per acre without fertilizer was 50 bushels.

This field was in corn and soybeans the year before the experiment was started.

All except the slipshucked corn was turned under for soil improvement. The growth of soybeans was about 3000 pounds per acre.

Reference: U. S. D. A. Technical Bulletin 452, pages 18, 19 and 21, "Experiments with Nitrogen Fertilizers on Cotton Soils," Washington, D. C.

XII

Table 34. Comparative Effects of Sodium Nitrate, Ammonium Sulphate, and Urea, As Sources of Nitrogen, In Mixtures with Phosphate and Potash for Cotton On Ruston Sandy Loam at Fayetteville, N. C. (Being a recapitulation of Tables 20, 33 and 43)

(48-64-64 Lbs. N-P-K per acre) 6-8-8 fertilizer applied at rate of 800 lbs. per acre.

Composition of Nitrogen in Fertilizer	Pounds N-P-K Applied				Lbs. Seed Cotton Per Acre From:			
	At Planting	At Chopping	8 Weeks After Chopping	Total	Year	Nitrate of Soda	Sulphate of Ammonia	Urea
Single source	48-64-64	0	0	48-64-64	1931	2100	1975	1975
					1932	1437	1387	1437
					1933	2150	1788	1762
					Av.	1896	1717	1725
In various proportions.... of cottonseed meal, average 5 mixtures	48-64-64	0	0	48-64-64	1931	2108	2112	2028
					1932	2108	2112	2028
					1933	2099	1868	1930
					Av.	1893	1829	1797
Single source	24-64-64	24	0	48-64-64	1931	1975	1743	1906
					1932	1306	1299	1318
					1933	1675	1580	1572
					Av.	1652	1541	1599
Single source	16-64-64	16	16	48-64-64	1931	1912	1755	1987
					1932	1480	1389	1300
					1933	1857	1788	1837
					Av.	1750	1644	1708
With Ammonium Phos- phate ..	48-64-64	0	0	48-64-64	1931	1836	1675	1812
					1932	1324	1292	1268
					1933	1603	1557	1200
					Av.	1587	1508	1427
Average ..						1755	1648	1651

Reference: U. S. D. A. Bulletin 452, page 22, "Experiments With Nitrogen Fertilizers on Cotton Soils", Washington, D. C.

A Comparison of Different Sources of Nitrogen for Cotton on Limed and Unlimed Norfolk Sandy Loam in Alabama

In 1926, field tests were started on a Norfolk sandy loam to study, first, the influence of various nitrogenous fertilizers on cotton yields on unlimed and limed land during a period of years, and second, the influence of these nitrogenous fertilizers on the soils, with particular reference to the amount of acidity developed and changes in the replaceable base content. One-half of each area was limed in the spring of 1928 by the addition of enough limestone to bring the reaction of the soil to pH 6.5 plus an amount sufficient to neutralize the acid which would be developed by the nitrogenous fertilizers used for a period of four years. At the end of each four-year period, sufficient limestone is to be added to neutralize the acidity developed by the nitrogenous fertilizer for the ensuing four years.

Nitrogen was applied annually to all plots at the rate of 45 pounds per acre, with the exception of a single plot in each test which received no nitrogen. All of the plots received annually 96 pounds of phosphoric acid per acre except Plot 10 which received 195 pounds from Ammo-Phos A. Muriate of potash was applied to all plots at the rate of 100 pounds per acre. The phosphorus, potassium, and one-half of the nitrogen were applied only a few days before planting the cotton except for the plots which received Ammo-Phos A and calcium cyanamid; on these two plots, except in 1926 and 1927, all of the nitrogenous fertilizer was added from 10 to 14 days before planting. When nitrogen was used as a side dressing, it was applied im-

Table 35. Yield of Seed Cotton From Various Sources of Nitrogen on Unlimed and Limed Norfolk Sandy Loam in Alabama

Plot No.	Source of Nitrogen	Lbs. Lime stone Per Acre	Limed Land					Unlimed Land						
			Yield in		Lbs. Seed	Cotton	Yield in Pounds		Seed	Cotton				
			1928	1929			1930	1931			1926	1927	1928	1929	1930	1931
1	Sodium Nitrate	1100	1356	1040	966	1932	1188	1122	1180	884	944	978	1472	1096
2	Sodium Nitrate 3/5	1100	1168	1056	1048	1584	1214	1272	1062	1080	968	1033	1456	1134
3	Ammonium Sulphate 2/5	2270	1200	1068	1119	1620	1252	1262	787	1004	920	731	1360	1011
4	Ammonium Sulphate	1980	888	1064	832	1628	1103	1480	935	716	1036	853	1484	1048
5	Leunasulphate	1100	924	928	759	1740	1088	1410	1158	796	960	829	1632	1131
6	Sodium Nitrate	1100	384	432	452	704	493	732	323	256	320	387	672	448
7	None	1100	928	1000	840	1544	1078	563	740	996	928	1576	961	1060
8	Calcium Cyanamid	1100	1204	1016	851	1544	1154	1076	1101	1032	988	910	1472	1096
9	Ammonium Sulphate (Basic Slag)	1100	1052	1012	854	1524	1110	1370	1303	860	1024	928	1544	1171
10	Sodium Nitrate	2270	1236	924	877	1572	1152	1436	1048	972	588	402	1508	991
11	Ammo-Phos. A	1690	1348	1052	1020	1580	1250	1154	936	1048	753	1588	1096	1081
12	Urea	1100	880	976	756	1528	1035	1482	1394	536	1028	792	1640	1145
13	Sodium Nitrate	1100	1344	996	925	1484	1187	1117	1128	1048	1136	1544	1195	1214
14	Sodium Nitrate	1100	1240	1072	1141	1644	1274	993	1016	1108	1018	1620	1151	1173
15	Calcium Nitrate	1100	940	1024	936	1488	1097	879	972	1028	803	1384	1013	1047
16	Cottonseed Meal	1100	1128	1104	859	1672	1191	1161	1020	1088	919	1664	1170	1173
Av.	Sodium Nitrate	1114	1009	853	1557	1133	1346	1218	871	1015	935	1583	1151	1100

† Five year average. Reference: Alabama Agricultural Experiment Station Bulletin 238, pages 28-30, Tables 11-12, "Experiments with Commercial Nitrogenous Fertilizers," Auburn, Alabama, August 1932.

Boll weevil control measures were used some years.

Reference: United States Department of Agriculture Technical Bulletin 452, "Experiments With Nitrogen Fertilizers of Cotton Soils," Washington, D. C., October, 1934.

source of Phosphorus—Superphosphate containing 16% phosphoric acid.

Date of Applying Fertilizer in Relation to Planting Date—10 days before planting.

Variety used each year—Cleveland. **Latest Planting Date**—April 26.

How was Fertilizer applied in Relation to the Bed—In the furrow below the seed.

Size of Plots—1/20 acre. **No. of replications**—Three.

The experiment has been run continuously on the same land, each plot following itself each year of the experiment.

Boll Weevil Control Measures Used—Three applications of poison made each year. Before the experiment was begun the average yield of corn per acre without fertilizer was 20 bushels. Yield of seed cotton without fertilizer was 600 pounds (average).

XV

Cotton Nitrogen Sources Test On Tifton Sandy Loam, Tifton, Georgia

A co-operative experiment was begun in 1926, the purpose of which is to obtain a better understanding of the relative value of certain nitrogenous fertilizers in crop yields and soil reactions.

Laboratory work to determine the lime requirements on the plats treated with the different nitrogenous fertilizers is being done by the Alabama Experiment Station for the several southern stations co-operating on this project. One thousand pounds per acre of a 4-10-4 fertilizer, the ammonia being derived from different sources as indicated in Table 37, were used in order that the results might be compared with those from other experiment stations carrying on a similar project.

Table 37. Nitrogen Sources Tests

Source of Nitrogen	40-100-40 Lbs. N-P-K Per Acre (Equivalent to 1000 Lbs. 4-10-4 Fertilizer)									
	1926	1927	1928	1929	1930	1931	1932	1933	4 Year Average 1926-29	8 Year Average 1926-33
Nitrate of Soda	1181	842	609	719	827	1120	1282	1563	838	1018
60% Nitrate of Soda and 40% Sulphate of Ammonia	1112	756	576	745	571	1100	1056	1388	797	913
Sulphate of Ammonia and Basic Slag	1259	721	621	553	769	1120	1010	1672	789	966
Leunaspiter	1179	783	513	603	885	1030	1048	1452	770	937
Cyanamid	973	718	741	555	886	1136	1153	1514	747	959
Sulphate of Ammonia	1110	705	592	515	836	1062	815	1240	731	859
Urea	1149	640	528	540	899	1150	1208	1750	714	983
Ammonium Phosphate	806	453	588	620	855	1147	1074	1762	616	913
No Nitrogen	632	726	534	480	688	937	836	1017	593	731

The cotton work at the Georgia Experiment Station has been largely on a typical Tifton Sandy Loam with work also being done on a light phase of Tifton sandy loam which very closely resembles Norfolk sandy loam. The results of this work, therefore, should be applicable to both Tifton and Norfolk soil types.

Source of Phosphorus—Superphosphate containing 16% nitrogen.

Source of Potash—Muriate of potash.

Date of Applying Fertilizer in Relation to Planting Date—10 to 14 days before planting.

Average Planting Date—April 1st.

Variety Used Each Year—Petty's Toole.

Method of Applying Fertilizer in Relation to the Bed—Applied in furrow and bedded on. Fertilizer about 3 inches below seed.

Size of Plots—1/40 acre. **No. of replications**—Two.

Width of Rows—3.3 feet.

The experiment has been run continuously on the same land, each plot following itself each year of the experiment.

Cover Crops—None have been grown on this land during the progress of the experiment.

Boll Weevil Control Measures Used—Cotton was mopped once each year. About two pounds calcium arsenate per acre was applied.

Reference: Georgia Coastal Plain Experiment Station Bulletin 13, pages 6, 19 and 20, table 10, "Cotton Production In The Coastal Plain of Georgia," Tifton, Georgia, June 1930, and Georgia Coastal Plain Experiment Station Bulletin 24, page 17, table 5, "Fourteenth Annual Report," Tifton, Georgia, June 1934.

ORGANIC VS INORGANIC NITROGEN SOURCES FOR COTTON

Organic nitrogen sources are those containing carbon as an essential ingredient (not as carbonates). Originally the organic sources were limited to plant and animal products, but now many of the organic sources are being made chemically.

The following is a classification of some of the more common nitrogen sources:

ORGANIC: Cottonseed meal, urea, dried blood, tankage and fish scrap.

INORGANIC: Those with nitrogen alone are: Nitrate of soda (Chilean, Champion and Arcadian), Sulphate of ammonia, calcium cyanamid, calcium nitrate, leunasalpeter, cal nitro, and ammonium nitrate.

Those containing two plant nutrients are ammo-phos, diammo-phos, potassium nitrate, and potassium ammonium nitrate.

Those containing three plants nutrients are: Nitrophoska and ammophoska.

I

Table 38. Test of Ratio of Organic to Inorganic Nitrogen for Cotton on Tifton Sand Loam at Tifton, Georgia.

Treatment (Fertilizer: 2½-9-5)	Yield In Pounds Seed Cotton Per Acre					
	1929	1930	1931	1932	1933	Average 5 Years
500 Pounds, No Nitrogen	739	890	533	854	935	690
500 Pounds, All Organic	1035	492	816	913	1093	870
500 Pounds, ¾ Organic, ¼ Inorganic.....	980	488	802	1000	1203	894
500 Pounds, ½ Organic, ½ Inorganic.....	1030	559	740	975	1190	899
500 Pounds, ⅓ Organic, ⅔ Inorganic.....	955	559	693	1009	944	832
500 Pounds, 1/10 Organic, 9/10 Inorganic.....	960	556	660	1067	1030	855
500 Pounds, All Inorganic.....	1010	497	644	1107	1060	863
1000 Pounds, No Nitrogen.....	851	526	803	1028	1061	854
1000 Pounds, All Organic.....	1325	767	1240	1220	1537	1218
1000 Pounds, ¾ Organic, ¼ Inorganic.....	1385	774	1248	1325	1401	1227
1000 Pounds, ½ Organic, ½ Inorganic.....	1410	766	1176	1233	1289	1175
1000 Pounds, ⅓ Organic, ⅔ Inorganic.....	1290	617	1129	1273	1269	1115
1000 Pounds, 1/10 Organic, 9/10 Inorganic.....	1385	737	1117	1235	1190	1132
1000 Pounds, All Inorganic.....	1430	671	1163	1206	1297	1153

Fertilizer: 2½% nitrogen, 9% phosphoric acid, and 5% potash (Equivalent to 12½-45-25 lbs. N-P-K on the 500 lb. plots, and 25-90-50 lbs. N-P-K on the 1000 lb. plots).

Cotton—Ratio Of Organic to Inorganic Ammonia: The object of this experiment is to determine the ratio of organic to inorganic ammonia that should be included in a cotton fertilizer. As may be seen from Table 38 there are no marked differences in the average yield for the various combinations.

Source Of Organic Nitrogen—Cottonseed meal 7% Ammonia.

Source of Inorganic Nitrogen—Nitrate of soda containing 15% nitrogen.

Source of Phosphorus—Superphosphate containing 16% phosphoric acid.

Source of Potash—Muriate of potash containing 50% potassium.

Date of Applying Fertilizer in Relation to Planting Date—10-14 days before planting.

Average Planting Date—About April 1.

Variety Used Each Year—Petty's Toole.

Method of Applying Fertilizer in Relation to the Bed—Applied to furrow, bedded on fertilizer about 3 inches below seed.

Size of Plots—1/40 acre. **Number of replications—**Two.

Width of Rows—3.3 feet.

The experiment has not been run continuously on the same land.

Boll Weevil Control Measures Used—Mopped, using about two pounds calcium arsenate per acre each year.

Reference: Georgia Coastal Plain Experiment Station Bulletin 24, Page 20 and 21, Table 10, "Fourteenth Annual Report," Tifton, Georgia, June 1934.

II

Organic And Inorganic Nitrogen Sources Compared on Tifton Sandy Loam, Tifton, Georgia

Nitrogen from five organic and mineral sources is being applied to cotton in a complete fertilizer at planting, nitrate of soda, sulphate of ammonia, dried blood, tankage and cotton seed meal being used.

Table 39. Nitrogen Test

500 Lbs. of a 1%-8-6 Fertilizer ($8\frac{1}{3}$ -40-30 Lbs. N-P-K) Per Acre Applied at Time of Planting

Source of Nitrogen	Yield In Pounds Seed Cotton Per Acre									
	1922	1923	1924	1925	1926	1927	1928	1929	8 Yr.	9 Yr.
									Av.	Av.
Nitrate of Soda.....	902	550	924	1271	1112	1438	1042	1513	1094	1128
Dried Blood	812	570	941	1180	1036	1273	1037	1298	1018	1041
Sulphate of Amm.	814	591	955	1235	1078	1347	756	1353	1016	1052
Tankage ..	732	604	765	1102	1108	1253	1055	1278	987	1024
Cotton Seed Meal.....	370	502	868	1068	960	1159	862	1206	874	916
Check 0-8-6										
(No Nitrogen)	324	54	645	1005	532	1017	695	1047	665	696

The cotton work at the Georgia Experiment Station has been largely on a typical Tifton sandy loam with work also being done on a light phase of Tifton sandy loam which very closely resembles Norfolk sandy loam. The results of this work, therefore, should be applicable to both Tifton and Norfolk soil types.

Source of Phosphorus—Superphosphate.

Source of Potash—Muriate of Potash 50%.

Average Planting Date—April 1.

Variety Used Each Year—Petty's Toole.

Method of Applying Fertilizer in Relation to the Bed—Applied to the furrow and bedded on. Fertilizer about 3 inches below seed.

Size of Plots—1/20 acre. **Number of replications—**Two.

Width of Rows—3.3 feet.

The experiment has not been run continuously on the same land.

Over Crops—None have been grown just preceding this experiment.

Boll Weevil Control Measures Used—Mopped once, using about two pounds calcium

arsenate per acre.

Other Remarks that May Help in Interpreting the Data—This test followed a general crop rotation including corn, soybeans, and peanuts.

Reference: Georgia Coastal Plain Experiment Station Bulletin 13, page 6, 18 and 19, table 9, "Cotton Production in the Coastal Plain of Georgia," June 1930, Tifton, Georgia and Georgia Coastal Plains Experiment Station Bulletin 21, page 15, table 6, "Thirteenth Annual Report," Tifton, Georgia, June 1933.

III

Ratios of Organic to Inorganic Nitrogen for Cotton on Greenville Sandy Loam in Alabama

A study of the proper ratio of organic to inorganic nitrogen in fertilizers for cotton is being made on Greenville fine sandy loam on the Prattville Experiment Field. An application of 600 pounds of a 10-6-4 fertilizer was made on all plots which received nitrogen. The average of the first three years' results of this work is given as a progress report in the following table.

Table 40. Yield of Cotton from Applications of Varying Percentages of Organic and Inorganic Nitrogen on Greenville Sandy Loam 1929-31.

Plot No.	Fertilizer Per Acre		Percentage Nitrogen from			Av. Yield Seed Cotton in Lbs. Per Acre 1929-31
	Lbs. N-P-K	Equivalent to 600 Lbs. of	Cottonseed Meal	Sodium Nitrate	Ammonium Sulphate	
1.	0-60-24	0-10-4	....	....	....	527
2.	36-60-24	6-10-4	75	25	....	873
3.	36-60-24	6-10-4	50	50	....	861
4.	36-60-24	6-10-4	35	65	....	899
5.	0-60-24	0-10-4	....	....	....	605
6.	36-60-24	6-10-4	20	80	....	1,046
7.	36-60-24	6-10-4	10	90	....	1,010
8.	36-60-24	6-10-4	....	100	....	1,107
9.	0-60-24	0-10-4	....	....	....	694
10.	36-60-24	6-10-4	33 1/3	33 1/3	33 1/3	1,070
11.	36-60-24	6-10-4	....	100*	....	1,040
12.	36-60-24	6-10-4	....	75	25 2/	1,016
13.	0-60-24	0-10-4	....	....	....	602

* Twenty-five per cent of the nitrogen on this plot used at planting time and 75 per cent immediately after thinning.

2/ Ammonium sulfate used at planting time and sodium nitrate used immediately after thinning.

The results during the three years that these tests have been in operation need not be materially changed by the addition of the results for other years. This statement is based on the fact that each of the last three years has been a season of low rainfall during the months of June, July, and August.

The greatest increase from the use of nitrogen was obtained where all of the nitrogen was applied in the form of sodium nitrate at planting time. The second largest increase was obtained when the nitrogen was derived equally from sodium nitrate, ammonium sulfate, and cottonseed meal applied at planting time.

Source of Phosphorus—Superphosphate containing 16% phosphoric acid.

Source of Potash—Muriate containing 50% potash.

Date of applying fertilizer in relation to planting date—10 days before planting.

Average Planting Date—About May 1.

Variety Used Each Year—Cook.

Method of Applying Fertilizer in Relation to the Bed—Put in waterfurrow and bedded on.

Size of Plots—1/30 and 1/40 acre. **Number of replications**—Two.

Width of Rows—3 1/2 feet. **Spacing of Plants in drill**—18 inches.

The experiment has been run continuously on the same land, each plot following itself each year of the experiment.

Cover Crops—None have been grown during the progress of the experiment.

Boll Weevil Control Measures Used—None.

Reference: Alabama Bulletin 238, Pages 15, 17, and 18, Table 5, "Experiments With Commercial Nitrogenous Fertilizers," Auburn, Alabama.

IV

Table 41. Organic Versus Inorganic Nitrogen Sources for Cotton on Cahaba Soil on The Farm of K. L. Spurlock, Columbus, Mississippi.

600 Lbs. 4-8-1 Per Acre From: %	Inorg.	Increase Over 600 Lbs. 0-8-4 In Pounds Seed Cotton Per Acre			
		1931	1932	1933	1934
0	100	-124	366	399	504
50	50	-20	279	378	380
75	25	-53	298	433	457
100	0	96	293	385	444
100	B. S. 1/	153	176	307	460
	Milorganite 2/	127	360	318	471
	No Fertilizer		-175	-183	-71
Actual Yield with 600 Lbs. 0-8-4 Per Acre.		612	555	726	662
					639

In this case Urea and Cottonseed Meal were used as the organic sources while Chilean Nitrate of Soda was used as the inorganic source.

1/ B. S.—Basic Slag

2/ Processed sewerage sludge.

Size of Plot—1/50 acre in 4 replications.

TIME OF APPLICATION OF NITRATE OF SODA TO COTTON

I

Table 42. Tests On Time Of Application Of Nitrate Of Soda To Cotton In South Carolina

All plots except checks. received 200 pounds Chilean Nitrate of Soda, 400 Pounds Superphosphate and 75 Pounds Muriate of Potash, (30-64-36 Pounds N-P-K Per Acre)

Rate and Time of Application of Nitrate of Soda	Sand Hill Experiment Sta. Norfolk Sand				J. P. Able's Farm Norfolk Fine Sandy Loam		
	1928	1929	1930	3 Yr. Av.	1928	1929	2 Yr. Av.
No Fertilizer	50	20	3	24	950	1370	1160
No Nitrate of Soda*	307	76	108	164	833	1207	1020
100 Pounds at Planting	588	293	375	419	880	1440	1060
50 Pounds at Planting							
150 Pounds at Chopping	651	415	433	499	970	1720	1345
100 Pounds at Chopping	688	353	483	508	910	1720	1315
100 Pounds at Planting							
100 Pounds 3 Weeks After Chopping	538	205	350	364	1100	1630	1365
100 Pounds at Planting							
100 Pounds 6 Weeks After Chopping	438	140	263	280	1120	1580	1350
100 Pounds at Chopping							
100 Pounds 6 Weeks After Chopping	538	220	300	353	1260	1660	1460

* Average of 3 checks.

The Sand Hill Experiment Station is located in Richland County while the J. P. Able farm is located in Lexington County. Both of these counties are in about the same latitude as Monroe, Chickasaw, Calhoun, Yalobusha, Tallahatchie and Bolivar counties, Mississippi.

Reference: South Carolina Bulletin 283, pages 9, 10 and 11, tables 6, 7 and 8, April 1932. "Experiments on Rate and Time of Applying Nitrate of Soda," Clemson College, S. C.

II

Table 43. Effect of Time of Application of Nitrogen on Stand, Yield, and Earliness of Cotton on Ruston Sandy Loam, Fayetteville, N. C.

Source of Nitrogen	Fertilizer Applied Per Acre			Yield in Pounds Seed Cotton Per Acre					
	At Planting	Pounds N-P-K Applied		1931		1932		1933	
		Chop- ping	After 3 Weeks Chopping	Yield Per Acre	Cotton Open First Pick- ing %	Yield Per Acre	Cotton Open First Pick- ing %	Yield Per Acre	Cotton Open First Pick- ing %
Nitrate of Soda	48-64-64	0	0	2,100	74	1,437	55	2,150	81
	24-64-64	24	0	1,975	80	1,306	52	1,675	82
	16-64-64	16	16	1,912	83	1,480	58	1,857	85
Sulphate of Ammonia	48-64-64	0	0	1,975	76	1,387	54	1,788	84
	24-64-64	24	0	1,743	82	1,299	56	1,580	87
	16-64-64	16	16	1,755	81	1,389	59	1,788	88
Urea	48-64-64	0	0	1,975	78	1,437	54	1,762	88
	24-64-64	24	0	1,906	79	1,318	56	1,572	88
	16-64-64	16	16	1,987	81	1,300	53	1,837	91
No Fertilizer				1,025	89	762	60	870	67
Average 3 Plots								886	72
									4

Preceding the inauguration of the experiment the field had grown cotton in rotation with corn interplanted with soybeans. The vegetation produced by the soybeans was plowed under in the field for green manure. By this practice the soil had been maintained at a high level of fertility, and large yields of cotton were secured. The year preceding the inauguration of the experiment, the field was in corn and soybeans and a mass of vegetation from the soybean vines was turned under late in the fall. Cotton was grown continuously in the experiment for 3 years, each plot receiving identical fertilizer treatments each year, and no vegetation except cotton stalks was grown or turned under during the 3 years period.

Source of Phosphorus—Superphosphate containing 16% phos phoric acid.

Source of Potash—Sulphate of Potash—48% potash.

Average Planting Date—April 20.

Variety Used Each Year—Coker's Farm Relief.

Method of Applying Fertilizer in Relation to the Bed—Applied in drill, stirred and covered so that when seed are planted fertilizer will be about 3 inches below seed. Delayed applications made on the side of row by hand.

Size of Plots—1/25 acre. **Number of Replications**—Two.

Width of Rows—3 1/2 feet

The experiment has been run continuously on the same land, each plot following itself each year of the experiment.

Cover Crops—None have been grown on this land during the period of the experiment.

Boll Weevil Control Measures Used—None except that early shedded squares were picked up.

Before the experiment was begun the average yield of corn per acre without fertilizer was 50 bushels.

This field was in corn and soybeans the year before the experiment was started. All except the slipshucked corn was turned under for soil improvement. The growth of soybeans was about 3000 pounds per acre.

Reference: United States Department of Agriculture, Technical Bulletin 452, page 24, table 11, "Experiments with Nitrogen Fertilizers On Cotton Soils," Washington, D. C., October, 1934.

PHOSPHORUS SOURCES

I

Table 44. Phosphorus Sources Test On Lintonia Silt Loam At Holly Springs Branch Experiment Station, Holly Springs, Mississippi.

Plot No	Phospatic Fertilizers Applied	Increase Over No Phosphorus				
		1929	1930	1931*	1933	1934
3	300 Lbs. Superphosphate.....	73	5	206	364	113
4	300 Lbs. Basic Slag.....	.....	.....	.....	180	100
6	300 Lbs. Ruhm's Phos.....	65	45	65	.....	111
7	300 Lbs. Colloidal Phos.....	50	-60	25	152	57
8	No Phosphorus (actual yield).....	918	954	570	762	858
Av. 1, 5 & 9	No fertilizer (actual yield) ..	.....	825	295	609	718
						611**

Each plot including check, received 36 pounds each of nitrogen and potash per acre.

* No experiment run in 1932 due to lack of funds.

** Four year average.

Source of Nitrogen—Nitrate of Soda containing 15% nitrogen, 1934— 16% nitrogen.

Source of Potash—Muriate containing 50% potash.

Date of Applying Fertilizer in Relation to Planting Date—A few days prior to planting.

Average Planting Date—May 8. **Earliest planting date during test**—May 2. **Latest planting date**—May 22.

Variety Used Each Year—Stoneville No. 2 through 1930. Stoneville No. 3 to date.

Method of Applying Fertilizer in Relation to the Bed—In shovel furrow in the list.

Size of Plots—1/20 acre. **Number of replication**—Three except in 1933, two then.

Width of Rows—40 inches.

Cover Crops—None grown during the period of the experiment.

The experiment has been run continuously on the same land, each plot following itself each year of the experiment.

Boll Weevil Control Measures Used—In 1933, one application at proper time, in 1934, three applications.

II

Table 45. Cotton Phosphorous Sources Test On Memphis Silt Loam At Natchez Branch Experiment Station, Natchez, Mississippi.

Source	Lbs. Per Acre	Yield in Lbs. of Seed Cotton Per Acre			
		1929	1930	1931	Average
6% Superphosphate ..	300	1142	786	1380	1103
Thum's phosphate ..	300	1100	772	.....	.....
Basic slag ..	300	.....	.....	1594	.....
No phosphate ..	.....	1064	788	1378	1077

Soil Type—Memphis Silt Loam.

Width of Rows—40 inches.

Spacing of Plants in the Drill—Approximately 4 plants to the foot.

Usual Time of Planting—April 15.

Time and Method of Applying Fertilizer—Spread in drill 5 to 10 days before planting.
Cotton planted over fertilizer.

Variety of Cotton Used—D. & P. L. No. 4.

Source of Nitrogen—Nitrate of soda containing 15% nitrogen.

Source of Potash—Muriate of potash containing 50% potassium.

Size of Plots—6/100 acre. **Number of replications**—Four.

Spacing of Plants in Drill—Approximately 4 plants to foot.

The test has been run continuously on the same land.

Boll Weevil Control Measures Were Used—1929, 3 applications, approximately 6 pounds each application; 1930, two applications, 7 pounds each application; 1931, 3 applications, 7 pounds each application.

Before the experiment was begun the average yield of corn per acre without fertilizer was 20 bushels. Yield of seed cotton without fertilizer was 800 pounds.

III

Table 46. Cotton Phosphorus Sources on Olivier Silt Loam at the Raymond Branch Experiment Station, Raymond, Mississippi.

Phosphorus Source	Lbs. N-P-K	Equivalent to 508 lbs. of	Increase Over No Phos. in Lbs. of Seed Cotton Per Acre			
			1929	1930	1931	3 Year Av.
Superphosphate	30 1/2 - 61 - 30 1/2	6-12-6	234	52	440	242
Rhum's Phosphate	30 1/2 - 122 - 30 1/2	6-24-6	69	-26	124	56
Ammophoska	30 1/2 - 61 - 30 1/2	6-12-6	49	83	-208	-25
Superphosphate	30 1/2 - 61 - 30 1/2	6-12-6	234	84	346	221
None (actual yield)	30 1/2 - 0 - 30 1/2	6- 0-6	1112	1390	1147	1216

Test discontinued after 1931.

Nitrogen Fertilizer Applied—Chilean Nitrate of Soda. Superphosphate carried 16% and Rhum's carried 34%.

Date of Applying Fertilizer—1929, April 9; 1930, April 29; 1931, April 30; 1933, No work; 1934, No work.

Date of Planting Cotton—1929, May 2; 1930, May 1; 1931, May 1.

Variety of Cotton Used—1929, Lone Star 65; 1930, Lone Star 65; 1931, Lone Star 561

Size of Plots—1/20 acre. **Number of replications**—10.

Width of Rows—3 1/2 feet.

Spacing of Cotton in Drill—Three stalks every foot.

Method of Applying Fertilizer—In bottom of bed, and bedded upon.

Reference: Record cards of the Station.

POTASH SOURCES

I

Table 47. Potash Sources Test On Cotton On Olivier Silt Loam at Raymond Branch Experiment Station, Raymond, Mississippi

Fertilizer Used	Increase Over No Potash in Lbs. Seed Cotton Per Acre						
	1929	1930	1931	1932	1933	1934	6 Yr. Av.
48-96-48 Lbs. N-P-K or 800 Lbs 6-12-6 from							
Kainit	229	659	180	608	460	339	412
Muriate	277	563	325	421	626	193	401
Sul. Pot. Magnesia	354	666	273	528	626	331	463
Sulphate of Potash	327	769	278	529	794	169	478
Manure Salt	267	566	281	407	469	336	388
No Potash 6-12-0 (actual yield)	1673	1605	1233	1440	1476	1179	1434
No Fertilizer	-497	-484	-323	-382	-279	-631	-433

Soil Type—Olivier Silt Loam.

Nitrogen Fertilizer Applied—Chilean Nitrate of Soda.

Phosphorus Fertilizer Applied—16 and 20% Superphosphate.

Available Potash Applied Per Acre—48 pounds.

Planting Date—1928, May 1; 1930, May 3; 1931, planted April 30, planted over May 18 and again May 28; 1932, May 4; 1933, May 4; and 1934, April 20.

Date of Applying Fertilizer—1928-1929, April 22; 1930, May 2; 1931 and 1932, April 29; 1933, April 24; 1934, April 14.

Size of Plot—1/20 acre repeated 4 times.

Variety of Cotton Used—1929, Lone Star 168; 1930, Lone Star 168; 1931, Lone Star 168; 1932-33 Lone Star 561 and 1934, Starfos.

Width of Rows—3½ feet.

Spacing of Cotton in Drill—2 Stalks per foot (valley land).

Poison Applications—1929, 3 applications; 1930, on August 1, and August 9, to control Army Worm. In 1933, poison was applied twice, and 3 times in 1934.

II

Table 48. Cotton Potash Sources Test On Lintonia Silt Loam At Holly Springs Branch Experiment Station, Holly Springs, Mississippi.

Potash Sources	Increase Over No Potash in Pounds Seed Cotton Per Acre									
	1926	1927	1928	1929	1930	1931	1933	1934	8 Yr. Av.	5 Yr. Av.
14% Kainit	362	76	302	102	114	113	69	35	146.6	86.6
50% Muriate	351	201	132	93	123	118	44	50	139.0	85.6
50% Sulphate Potash	150	98	64	36	64	101	103	-39	72.1	53.0
20% Manure Salt	.....	.....	.....	87	31	6	107	22	.....	50.6
Trona	19	219	169	59	61	-35	.....	.....	.....	.....
No Fertilizer	.....	.....	.....	-373	-338	-631	-533	-269	.....	-429
(Actual Yield)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
No Potash	1571	1027	1383	826	796	854	1056	782	1036.8	862.8

1926-28—22½-48-24 pounds N-P-K per acre.

1928-34—36-72-36 pounds N-P-K per acre.

Fertilizer—1926-28, all plots, including checks, received 300 pounds superphosphate and 150 pounds nitrate of soda per acre. The potash carriers were applied at such rate as to provide 24 pounds of available potash per acre. 1929-34, 36 pounds available potash per acre on the potash plots, while all plots received 240 pounds nitrate of soda and 450 pounds superphosphate.

Soil Type—1926-27-28, unimproved sandy loam valley land, Lintonia silt loam. 1929 and since, thin level brown loam (Memphis silt loam) that has been grown to cotton for fifty years with little if any soil improvement methods used.

Size of Plots—1/20 acre repeated 3 times.

Variety of Cotton Used—1926-27, Mississippi Station Trice; 1928, Lone Star 79.

Width of Rows—Three and one half feet.

Planting Date—1927, May 18; 1928, May 14.

III

Table 49. Potash Sources Test On Ruston Fine Sandy Loam At Poplarville, Miss., (Moody Field)

24-48-24 Lbs. N-P-K		Increase Over 600 Lbs. 4-8-0 In Lbs. Seed Cotton Per Acre				
Per Acre, or		1926	1927	1929	1930	4 Yr. Av.
300 Lbs. 4-8-4 2/ from:						
Muriate of Potash	.....	-44	207	220	76	115
Sulphate of Potash	.....	7.5	74	338	84	126
Kainit	.....	48.5	169	158	250	156
Manure Salt	.....	.....	84	155	116	.....
Semfert (Trona)	.....	11	74	68	1/	.....
Field Per Acre from 600 Lbs. 4-8-0	.....	1003	676	1142	920	935

1/ Unable to obtain trona potash in 1930.

2/ Changed to 800 Lbs. 4-8-4 in 1929, or 32-64-32 Lbs. N-P-K per acre.

Soil Type—Ruston fine sandy loam.

Date of Applying Fertilizer—1927, April 1-10; 1929, April 10; 1930, March 25.

Methods of Applying Fertilizer—Applied in water furrow and bedded on.

Planting Date—1927, April 1-10; 1929, April 25; 1930, April 21.

Variety of Cotton—1927, Lone Star 65; 1929, D. & P. L. 5242A-310-46; 1930, D. & P. L. station selection.

Size of Plots—1/20 acre repeated 3 times.

Width of Rows—3½ feet.

Spacing of Plants in Drill—Hoe width.

Poison Applied—1927, 3 applications.

The test was not reported in 1928 due to poor stand caused from "damping off."

IV

Table 50. Effect of Various Potash Sources on Cotton Wilt on Ruston Fine Sandy Loam at the Poplarville Branch Experiment Station, Poplarville Mississippi. (Boyd Smith Field)

Each Plot Except Checks Received 48-64-32 Lbs. N-P-K Per Acre. (Equivalent to 800 Lbs. 6-8-4 per acre)

Source of Potash	Increase Over No Potash In Pounds Seed Cotton Per Acre				
	1928	1929	1930	1931	Average
Muriate of Potash	-75	67	115	179	71
Sulphate of Potash	-55	69	156	82	63
Kainit	-74	36	157	138	64
Manure Salt	-41	-32	90	48	16
None—Actual yield from 800 Lbs. 6-8-0 per acre	638	1465	1025	1059	1047

The soil on which the experiment was run was inoculated with wilt culture each year.

Average Planting Date—April 10 to 20. **Earliest Planting Date During the Test**—

April 3. **Latest Planting Date**—April 21, except in 1928 when it was planted over the third time on May 4.

Variety Used Each Year—Cleveland 54 in 1928. Other years, a station selection of D. & P. L. (5242A-310-46).

Method of Applying Fertilizer—Distributed in water furrow and bedded on.

Size of Plots—1/20 acre. **Number of replications**—Three.

Width of Rows—3½ feet. **Spacing of Plants in Drill**—8 to 9 inches.

The experiment has been run continuously on the same land, each plot following itself each year of the experiment.

Cover Crops—Oats have been grown each year.

Boll Weevil Control Measures Used—Two to three applications of calcium arsenate dust of three to four pounds each have been applied each year.

V

Table 51. Effect Of Potash Fertilizer On Cotton Wilt At The Poplarville Branch Experiment Station, Poplarville, Mississippi, (Neal Field) Ruston Fine Sandy Loam

Fertilizer Applied Per Acre

Source of Potash	Equivalent to		Increase Over No Potash In Pounds Seed Cotton Per Acre						
	Lbs. N-P-K	600 lbs. of	1927	1928	1929	1930	1931	Average	
Muriate of Potash	36-48-48	6-8-8	448	177	450	0	71	229	
Sulphate of Potash	36-48-48	6-8-8	290	149	825	76	89	286	
Manure Salt	36-48-48	6-8-8	367	218	870	102	171	346	
Kainit	36-48-48	6-8-8	424	257	573	153	149	311	
Muriate of Potash	36-48-24	6-8-4	347	132	465	68	90	220	
Muriate of Potash	36-48-60	6-8-10	403	83	-102	153	-10	105	
Muriate of Potash	36-48-72	6-8-12	288	43	-102	102	116	90	
None (actual yield)	36-48-0	6-8-0	*	500	966	1156	1122	936	
No Fertilizer	None	0-0-0	-325	-95	-669	-298	*	-354	

* No yield recorded.

Reference: Georgia Coastal Plain Experiment Station Bulletin 13, pages 6, and 21 table 11, "Cotton Production in the Coastal Plain of Georgia," Tifton, Georgia, June, 1930. Georgia Coastal Plain Experiment Station Bulletin 24, table 8, "Fourteenth Annual Report," Tifton Georgia, June 1934.

the soil on which this test was conducted was inoculated with wilt fungus each year.

Source of Nitrogen—Nitrate of soda containing 16% nitrogen.

Source of Phosphorus—Superphosphate containing 16% phosphoric acid.

Average Planting Date—April 10 to 20. **Earliest Planting Date**—First week in April. **Latest Planting Date**—Last week in April.

Variety Used Each Year—A station selection of D. & P. L. (5242A-310-46)

Method of Applying Fertilizer in Relation to Bed—Applied in the water furrow and bedded on.

Width of Rows—3½ feet. **Spacing of Plants in Drill**—8 to 10 inches.

Size of Plots—1/12 acre.

Cover Crops—Oats were grown each year.

Boll Weevil control measures were used.

VI

COTTON POTASH SOURCES ON TIFTON SANDY LOAM, TIFTON, GEORGIA.

Table 52 gives the yields for the eight-year period 1922-29 of cotton fertilizer with a complete fertilizer, the potash being derived from different sources. The plots receiving no potash are used as checks or controls in these tests.

Table 52. Cotton—Sources Of Potash Test
600 Pounds of 2½-9-5 Fertilizer (15-54- 30 Lbs. N-P-K) Applied at the Time of Planting

Source of Potash	Yield in Pounds Seed Cotton Per Acre										7 Yr. Av. 1923-29	11 Yr. Av. 1923-33
	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	
Kainit	733	1105	1436	1202	1415	1330	1310	1585	1140	1059	1372	1219
Sulphate of Potash	662	1086	1428	1222	1422	1123	1348	1537	996	1188	1390	1244
Muriate of Potash	621	1048	1321	1206	1385	1195	1290	1415	993	980	1275	1184
Manure Salts	656	1107	1143	1139	1250	1130	1345	1582	964	.....	.....	1157
No Potash	433	770	950	735	742	642	880	598	650	586	1180	1110
												733
												742

The cotton work as the Georgia Coastal Plain Experiment Station has been largely on a typical Tifton sandy loam with work also being done on a light phase of Tifton sandy loam which very closely resembles Norfolk sandy loam. The results of this work, therefore, should be applicable to both Tifton and Norfolk soil types.

References: Georgia Coastal Plain Experiment Station Bulletin 13, page 6, and 21, table 11, "Cotton Production in the Coastal Plain of Georgia," Tifton, Georgia, June 1930. Georgia Coastal Plain Experiment Station Bulletin 24, table 8, "Fourteenth Annual Report", Tifton Georgia, June 1934.

Source of Nitrogen—Nitrate of Soda containing 15% nitrogen.

Source of Phosphorus—Superphosphate containing 16% phosphoric acid.

Date of Applying Fertilizer in Relation to Planting Date—10 days or 2 weeks in advance.

Average Planting Date—April 1.

Method of Applying Fertilizer in Relation to the Bed—Applied to row, bedded on.
Fertilizer about 3 inches below seed.

Size of Plots—1/20 acre. **Number of Replications**—Two.

Width of Rows—3.3 feet. **Spacing of plants in drill**—12 to 14 inches.

The experiment has not been run continuously on the same land.

Boll Weevil control measures used—Mopped once using about 2 pounds calcium arsenate per acre.

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Quadrennial Report

OF THE

SOUTH MISSISSIPPI BRANCH EXPERIMENT STATION

J. C. ROBERT, Superintendent
S. R. GREER, Assistant



18 Months Old Tung Trees (Cultivated) No Fertilizer and No Cover Crops Used.

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
STATE COLLEGE, MISSISSIPPI

J. R. RICKS, Director

South Mississippi Branch Experiment Station

A Summary of Investigations Made During the Years 1932 to 1935 Inclusive

Farm research is an effort to discover the practices influencing growth and production of plant and animal life; it is search for facts. For the discovery of such facts there is an immense amount of work involving many details and careful investigations. Recent publications made by the Division of Engineers and Industrial Research of the National Research Council show expenditures for research made by 800 large manufacturing companies which had a rating of \$1,000,000.00 or more. Among these companies are listed the manufacturers of automobiles, chemicals, foods, steel, leather, lumber, metal work, paper, rubber, and textiles. Officials of these companies said that the money spent on research which averaged \$13.00 for every \$1,000.00 invested, was among the most profitable investment they have made in connection with their business.

The average farmer has neither the time, money nor training for such scientific work. The Federal and State governments realizing this fact, have established experiment stations for the purpose of aiding the farmers. During the past half century the art of farming has developed more than it has in the combined centuries of historic records. It is interesting in this connection to bear in mind that the first Agricultural Experiment Station in the United States was established approximately 50 years ago.

FARM LABORATORIES

This Experiment Station is a research farm laboratory. We trust none of our readers have conceived the erroneous idea that such farm laboratories were ever established with the view of growing produce for sale and of, thereby, making money. These Stations were never brought into existence, nor thought of for that purpose, but designed for research into ways and means best suited to the production and utilization of farm produce, and to give, by visual instruction and printed publications, practical agricultural information best suited to the needs of the sections in which the stations are located. Of about 1,400 plots of this Station devoted to varieties of plants, preparation of seed-bed, fertilizer treatments, times of planting, cultural methods, harvesting and grading, many are from 1-20 to 1-40 of an acre in size. These plots were repeated a number of times in different sections of the field and the average production per acre secured.

Laboratory work in our colleges and universities is recognized and supported as essential in aiding those engaged in the so-call "learned" professions, as engineering, medicine, pharmacy, architecture, and dentistry. Such laboratories were never established for money-making, but for the discovery and teaching of facts. Research in the various departments of natural science, underlying the profitable production of plants and animals, is far more varied and intricate, and is just as essential to the citizenship of our State as is such work for the few engaged in the professions. Agricultural research is the key to the source of agricultural information. The research worker is confronted with the fact that "there is more unknown than known". This research requires painstaking, persistent, and concen-

trated effort on the part of the workers, based on facts already proven. For instance, in dealing with practical soil problems and their relation to fertility, the physical, geological, chemical and biological structure and properties of soil must be studied in the light of what research has already proven.

SOILS OF SOUTH MISSISSIPPI

The soil divisions of our section are the Longleaf Pine Area and Gulf Coastal Region including a part or all of 27 counties, embracing 8,000,000 to 10,000,000 acres of land upon which live over 500,000 citizens, most of whom will now have to depend on farming. A large percent of this population was formerly engaged in the lumber industry. In certain sections many people are in the transitional stage from lumbering to general and special lines of farming. Many of the latter class, as well as citizens who for years have been farming, annually make visits to this Station and review the experimental work now in progress.

The maximum production of home products, especially food and feed crops at least expense, is one of the most important lines of Station work. Obviously, this is based on increasing and maintaining soil fertility, since all plants and animals feed upon the soil and can be economically produced only when plant food can be secured from the soil.

In all Station work, ways and means of increasing soil fertility are of first consideration. This problem includes in the average cut-over pine land such practices as proper terracing of cultivated farms, the use of cover crops and of fertilizers, and proper methods of cultivation. Much of the land in this section should be, and some is being, reforested. A large percent of the remaining area should be used for the making of good pastures by soil binding grasses and legumes.

KEEP YOUR SOIL AT HOME

When land having a contour subjecting it to erosion is used for cultivated crops, it should be terraced to **MAKE the WATER RUN SLOWLY**; this decreases its soil carrying power. For this section of the State terraces with 2 to 2½ inches fall per 100 feet have been found most serviceable. The object here is to prevent destruction of farm land by removal of the top soil and plant food therein contained. It has been demonstrated that 21 times as much plant food is annually removed from the soil by erosion as that applied to it by commercial fertilizer. Mississippi has been investing each year from ten to fifteen million dollars for commercial fertilizer, and on the basis above mentioned, losing by leaching from farm soil, when not properly protected, from 210,000,000 to 315,000,000 dollars worth of plant food each year.

BRIEF OUTLINE OF SOME OF THE WORK DONE BY SOUTH MISS. BRANCH EXPERIMENT STATION

Besides the growing of all food and feed crops for man and beast, and for permanent soil improvement above mentioned, this Station is now engaged in experimental investigations in the growth of a number of cash crops.

It is also endeavoring to find crops that may be profitably marketed. Besides being grown at minimum expense, this produce must be properly graded, and placed in attractive form either in bulk, crates or packages.



**Sugarcane Experiment Plot. Poplarville Experiment Station, Showing Various Varieties.
C.O-290 Produced More Than 600 Gallons of Syrup Per Acre.**



Fourth year stubble cane of C. O. 290 produced 17.23 tons cane per acre in 1935. This variety has produced an average tonnage per year for 5 years of 28.6 tons per acre from one planting.

SUGAR CANE

For several years the Station has been conducting, in cooperation with the United States Department of Agriculture, investigations with the purpose in view of finding the best varieties of sugar cane adapted to the soil and climatic conditions of this area. In this work we have operated with 60 varieties of cane shipped us by the U. S. Department of Agriculture from practically all the cane growing sections in the world.

Among these canes we have found several varieties of superior merit. During the past two years we have discarded all but twenty varieties, retaining those that have thus far given us best results. According to a recent census there were planted for syrup production in Mississippi only 19,000 acres in sugar cane, most of which was grown in South Mississippi. The average syrup production of this cane was only 194 gallons per acre. The best variety grown has given an average during the past three years

SOUTH MISSISSIPPI BRANCH EXPERIMENT STATION

Sugar Cane Variety Test—Tons and Gallons Produced Per Acre

Variety	Plant Cane	Tons 1931	Gals. 1931	Tons 1932	Gals. 1932	Tons 1933	Gals. 1933	Tons 1934	Gals. 1934	Tons 1935	*Gals. 1935	Average Tons	Average Gals.
Cayana	Spring	29.59		23.25	440.0			21.19	236.0	23.83		24.46	338.0
CP 807	Plant	25.54		28.73	700.0			26.04	349.9	29.24		27.38	525.0
POJ 213	Plant	13.09		21.66	333.0			18.93	239.5	22.38		19.01	286.0
CO 290	Plant	27.73		28.83	608.0			24.90	342.8	26.75		27.05	475.0
Cayana	Fall			24.20	483.0	16.17	206.7	23.79	323.2	10.93		18.77	338.0
CP 807	Plant			29.31	500.0	20.60	305.5	26.92	367.0	26.02		25.71	391.0
POJ 213	Plant			14.50	283.0	10.13	156.1	19.97	271.1	16.48		15.27	237.0
CO 290	Plant			31.60	650.0	24.28	386.5	35.97	500.4	23.67		28.88	512.0
Cayana	First			30.00	633.0	22.82	324.1	28.18		28.93		27.25	479.0
CP 807	Stub.			34.23	733.0	21.03	305.3	39.65		37.35		30.87	519.0
POJ 213	Spring			21.31	406.0	5.90	85.6	26.01		21.74		16.31	246.0
CO 290	Plant			38.85	850.0	37.32	523.8	50.15		36.70		37.62	687.0
Cayana	First					25.28	377.8	9.02	125.3			17.15	252.0
CP 807	Stub.					24.87	395.1	31.28	442.0			28.07	419.0
POJ 213	Fall					7.37	106.8	13.85	196.8			10.61	152.0
CO 290	Plant					41.88	620.7	32.08	522.0			36.98	571.0
Cayana	Second					19.92	292.3	23.12	284.0			21.52	288.0
CP 807	Stub.					3.72	51.4	21.33	239.3			12.52	145.0
POJ 213	Spring					1.00	14.7	8.35	177.3			4.67	66.0
CO 290	Plant					32.26	474.0	49.35	733.3			40.80	603.0
Cayana	Second							13.88	178.9	2.70		8.29	179.0
CP 807	Stub.							27.40	355.9	24.20		25.80	356.0
POJ 213	Fall							11.13	142.9	10.16		10.64	143.0
CO 290	Plant							40.80	612.4	38.80		39.80	612.0
Cayana	Third							9.90	118.9			9.90	119.0
CP 807	Stub.							16.77	196.6			16.77	197.0
POJ 213	Spring							13.64	193.1			13.64	193.0
CO 290	Plant							27.05	411.5			27.05	412.0
Cayana	Fourth									2.17		2.17	
CP 807	Stub.									3.73		3.73	
POJ 213	Spring												
CO 290	Plant									17.23		17.23	

*The 1935 gallon production has not yet been completed by the Government Laboratory.

Average production per acre to date of all plantings—	Cayana	284.0
	CP 807	364.0
	POJ 213	189.0
	CO 290	553.0

(not including the present year, which figures have not been completed) of 553 gallons of syrup per acre.

This cane was secured from Coimbatore Experiment Station, Southeast India. It is a very prolific grower, extremely hardy and produces a number of stools. During the past few weeks farmers from Hancock County visiting our cane varieties, counted 35 stalks of cane in one hill from fourth year stubbles, or the fifth year's growth since it was first planted. According to the average production we have secured and at the present price of syrup the 19,000 acres planted in this variety of cane would annually have increased the revenue on this product \$2,432,190.00. We distributed during the last few years seed cane of this variety to approximately 4,000 farmers in various sections of the State.



Crotalaria Spectabilis in Corn.

LEGUMES

During the past five years we have endeavored to find the best reseed-ing summer and winter legumes for soil improvement purposes. This experiment has been based on the greatest improvement of soils at the least expense. This work requires the use of a reseedling annual planted to avoid each year the expense of purchasing seed for the succeeding year.

Among summer legumes we have used cow peas, crotalaria, lespedeza, Florida beggar weeds, soy beans and velvet beans. For our winter legumes we have grown vetches, Austrain peas, Canadian field peas and bur clover. Our experiment has not run sufficient length of time to enable us to speak positively, but present indications point toward the variety of crotalaria known as *spectabilis*, for summer growth and of bur clover for a winter cover crop, as being most economical.

There are approximately 600 varieties of crotalaria; we have grown about 20 varieties. *Crotalaria spectabilis* will not be eaten by livestock, which is one of the reasons we have given it preference. The soil needs

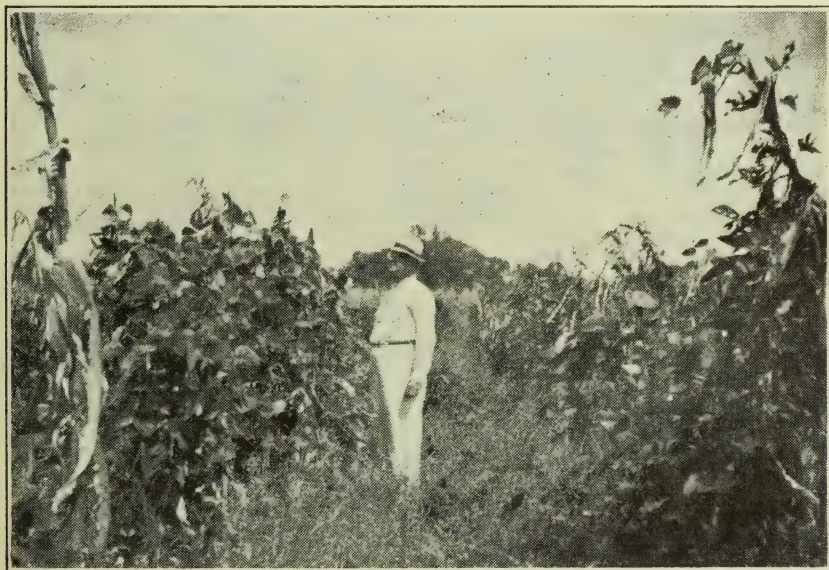
this nitrogen gathering and vegetative material turned under in order to make it productive. This variety of crotalaria has been growing in our satsumas grove for eight years with only one planting. It is a vigorously growing plant, seeds profusely and has produced on poor land 29 tons of green material per acre, which is turned under each year after the seed have matured.

We have grown bur clover in our cultivated field by making the rows 42 inches wide, sowing the seed in September and leaving without turning under a strip of land 6 to 8 inches in width. We plant our spring crops, and after the clover seed have matured turn this strip of land under at the last working of the crop, thus insuring reseedling of the land.

FERTILIZERS

We have conducted a series of tests comparing commercial with barnyard fertilizer. This fertilizer has been used in the even amounts of two to twelve tons of stable manure per acre with adjacent plots containing from 200 to 1200 pounds of 6-8-4 commercial fertilizer. The latter has cost at present retail prices about \$1.75 per hundred pounds.

Stable manure in the 3 year average in every case, except one, increased the yield above that of commercial fertilizer. Stable manure improves to a



Velvet beans rotated with corn.

ONE-THIRD CORN LAND ROTATED WITH LEGUMES

Plots	Legumes	Bushels Corn Per Acre		
		1934	1935	Average
1	None	19.6	22.8	21.2
2	Cow Peas	35.3	25.3	30.3
3	Soy Beans	29.1	27.4	28.2
4	Vel. Beans	30.1	28.6	29.3
5	Crotalaria	32.4	20.5	26.4
6	None	18.0	13.0	15.5

All plots received 400 lbs. of 0-8-4 commercial fertilizer. Six row plots, 1/20 acre each replicated six times.

marked extent the physical and bacteriological condition of the soil. Most of the farmers in South Mississippi have more or less livestock and at least a part of the farm should be improved each year by the use of stable manure. It has been thoroughly demonstrated by experimental investigations that based on the live weight of 1000 pounds, 10 to 12 tons of stable manure per year will be passed by cattle, 8 to 10 tons by horses and mules and 12 to 14 tons by hogs. The history of all countries and ages shows that for best returns animal and plant husbandry should go hand-in-hand.

COMMERCIAL FERTILIZER vs. STABLE MANURE

Under Cotton (3 year average)

Plots	Lbs. seed cotton P. A. Increase over check yield 1933	Lbs. seed cotton P. A. Increase over check yield 1934	Lbs. seed cotton P. A. Increase over check yield 1935	Pounds S. Cot. Per Acre 1935	Avg. Income Per Acre Over Check Yield	Inc. Value Seed Cotton @ 4 1/2c Per Pound	Retail Cost Com. Fert. @ \$1.75 Per Cwt.	Per. Ton Val. S. M. @ 4 1/2c Per Lb. for Seed Cot.
Check				138.0				
200 lbs. 6-8-4	248.0	172.0	162.29	306.0	194.1	\$ 8.25	\$ 3.50	
2 tons Stable Manure	234.0	238.0	436.48	586.0	302.3	12.16		\$ 6.08
400 lbs. 6-8-4	460.0	222.0	344.87	500.0	342.3	14.57	7.00	
4 tons Stable Manure.....	394.0	444.0	583.16	744.0	472.3	20.07		5.02
600 lbs. 6-8-4	548.0	412.0	429.45	596.0	463.2	19.69	10.50	
6 tons Stable Manure.....	388.0	456.0	571.74	744.0	471.9	20.06		3.34
Check				178.0				
800 lbs. 6-8-4	454.0	470.0	553.74	726.0	492.6	20.94	14.00	
8 tons Stable Manure.....	474.0	316.0	668.01	834.56	486.0	20.66		2.56
1000 lbs. 6-8-4	540.0	438.0	267.16	428.0	415.0	17.64	17.50	
10 tons Stable Manure	508.0	608.0	911.43	1056.66	675.8	28.81		2.88
1200 lbs. 6-8-4	700.0	412.0	482.58	632.0	531.5	22.59	21.00	
12 tons Stable Manure	694.0	638.0	1226.29	1370.0	852.8	36.24		3.02
Check				138.0				

Note: As a rule returns gradually decreased annually where com. fert. was used but in every case it more than paid for itself. The land annually became more productive on the stable manure plots. All plots, except checks, were planted to bur clover.



Preparation of land for cotton and corn.

Our experimental investigations show that commercial fertilizers are profitable when used as indicated by soil deficiencies. For the soils of our immediate section, commercial fertilizer analysis 6-8-4 (nitrogen, phosphorous and potash) will probably give as good or better results than other combinations. Summer and winter cover crops of a legume nature are preferable to others, since when properly inoculated they secure nitrogen from the air as it circulates through the soil. During winter there should be a protecting crops to lessen erosion and to utilize available plant food that would otherwise be leached from the soil, and these crops may also be used for grazing during the dry weather. One of the great needs of the soil in this section is decomposition of vegetative matter which is produced by turning under this vegetative and live stock manure.

COTTON VARIETIES (Average results from 4 year's work)

Varieties	Lbs. Lint 1932	Total Value 1932	Lbs. Lint 1933	Total Value 1933	Lbs. Lint 1934	Total Value 1934	Lbs. Lint 1935	Total Value 1935	Lbs. Lint Average	Total Value Average	Rank
D. P. L. 10	244.6	20.13	783.0	71.25	435.3	72.99	353.3	50.96	454.0	53.83	1
Lone Star 561	293.2	23.89	639.0	58.79	392.2	68.77			441.4	50.48	2
Stoneville 3	271.7	22.19			418.8	71.73	357.9	51.84	349.4	48.58	3
Stoneville 2	232.0	19.88			366.3	63.45	376.0	56.09	324.7	46.74	4
Lightening Express	178.2	16.20	727.0	72.70	321.6	57.91	197.9	31.92	356.1	44.68	5
Cleveland 54	187.9	15.23	705.0	64.26	335.9	55.77	285.6	40.92	378.6	44.04	6
Misdel 4	225.4	20.20			351.4	61.97	321.8	49.83	299.5	44.00	7
D. P. L. 11	244.8	20.21	691.0	64.95	328.4	55.57	235.2	34.62	375.8	43.83	8
Acala 4067	212.5	16.99	634.0	57.69	339.4	55.75			395.3	43.47	9
Farm Relief	226.2	19.55	570.0	53.58	372.7	62.41	245.2	36.80	353.5	43.08	10
Wilson Type	193.0	14.94	653.0	57.14	335.5	55.98			393.7	42.68	11
Misdel 3	195.3	18.35	499.0	50.15	306.9	57.77			333.7	42.09	12
Cleveland 884	155.5	12.86	679.0	62.47	368.6	60.69	202.5	29.92	351.4	41.28	13
Miller 610	157.6	12.89	555.0	50.51	348.8	58.51			353.8	40.63	14
Misdel 1	168.1	14.75	436.0	42.95	337.8	62.67			313.9	40.12	15
Delfos 531	186.4	17.37			310.1	55.30	258.3	43.85	251.6	38.83	16
Half & Half	153.1	10.60	541.0	43.28	329.8	46.17	322.2	41.77	329.7	35.45	17
Delta Type	126.4	11.61	429.0	43.11	210.8	39.76			255.4	31.16	18

All plots received 600 lbs. per acre of a 6-8-4 commercial fertilizer.



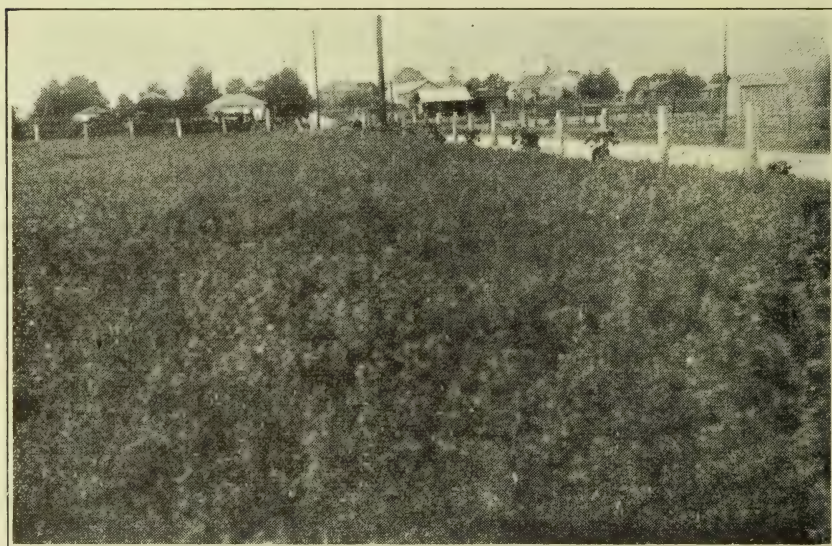
Cotton Varieties.

CORN VARIETIES

(Average results of 4 year's work)

Variety	Bushels of Corn Per Acre				Average	Rank
	1932	1933	1934	1935		
Golden Dent.		40.2	26.4	40.2	35.6	1
College Y-4	23.5	43.3	29.8	40.9	34.3	2
Hasting's Prolific	23.0	36.4	34.4	42.3	34.0	3
College 47	23.8	35.2	27.6	43.6	32.5	4
Jellicorse	23.1	37.0	29.8	39.5	32.3	5
College G-4	23.5	34.3	29.8	39.6	31.8	6
Golden Prolific		33.0	25.4	37.1	31.8	6
Mosby Woodruff	22.7	33.0	33.4	36.6	31.4	7
Marchetti Yellow		32.1	29.8	31.9	31.2	8
Mosby Delta	28.6	28.3	31.2	35.7	30.9	9
Laguna	26.6	29.0	28.0	37.8	30.3	10
Paymaster	17.5	32.5	26.3	44.5	30.2	11
Jarvis	22.7	34.3	25.9	34.5	29.3	12
Cocke's Pro. Station.	19.6	23.5	32.5	40.6	29.0	13
Mosby Station	16.6	21.7	27.2	35.7	25.3	14
Yellow Dent.	19.2	28.1	24.5	23.6	23.8	15

All plots received 600 lbs. per acre of a 6-8-4 commercial fertilizer.



Alfalfa—Soil plowed 6 to 8 inches deep and treated with 8 tons stable manure, 6.8 tons carbonate of lime and 350 pounds of superphosphate per acre. 4,295 pounds well cured hay per acre were produced the first year.

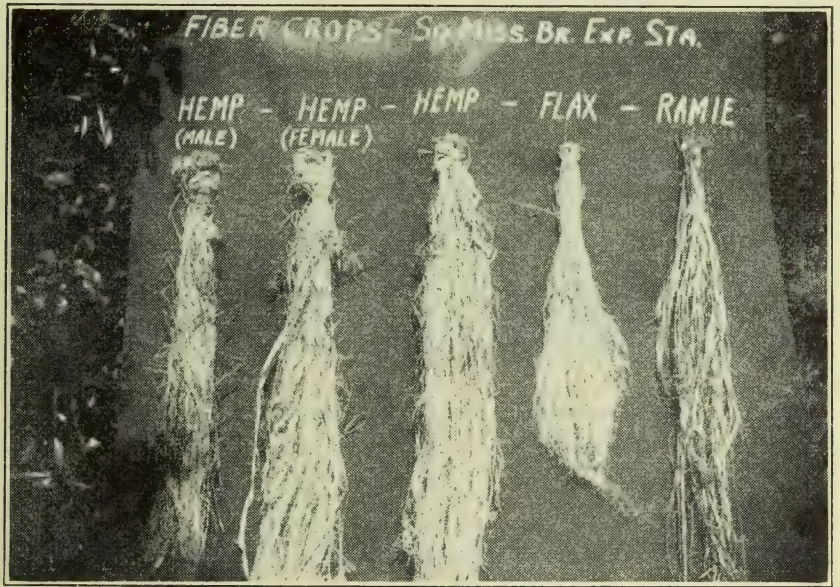
FIBER CROPS

During the past year we have grown hemp, flax, cotton and ramie side-by-side. All of these, with the exception of flax, have made a very creditable growth. Excellent crops of hemp and ramie were produced this year. A portion of this crop was sent north and processed by a recently patented machine and returned to us. The hemp is a beautiful, white, silk-like fiber several inches in length. We know nothing of construction of the new machine recently patented for this work, but indications point to the ability of our section to produce both hemp and ramie from one to

two, or more tons per acre. There is a possibility of one or both of these fibers assuming considerable importance as a cash crop. We are continuing our investigations along this line. If the new hemp machine will do the work that is claimed for it, we see no reason why it should not mean as much to the bast fiber industry as did the invention, in 1794, of Ely Whitney's cotton gin to the cotton industry.



Cotton (left), Flax (center), Hemp (right).



Fiber Crops.

HOG CROPS

We have grown hogs by allowing them to harvest most of their feed. For this purpose we have used rape, peanuts, soybeans, cowpeas, Jerusalem artichokes, sweet potatoes, corn, velvet beans, alfalfa and red clover. Peanuts gave 1.79 pounds increase in weight per day, per shoat over a period of six

weeks. With further reference to Jerusalem artichokes, we have grown and shipped to the Bureau of Standards, Washington, D. C., thirty tons of artichokes where they were converted into levelose (a type of sugar). The Jerusalem artichoke seems to be a most valuable crop for live stock. It is a vigorous plant and may be produced at comparatively little expense.

TUNG TREE CULTURE AT SOUTH MISSISSIPPI BRANCH EXPERIMENT STATION

Considerable interest in Tung Tree growth has been manifested in our section the past few years. There are two reasons for this. First, indications are that this plant when properly cared for will make as good growth in this section and will produce as large a harvest as will trees grown in any other part of the world. In the second place, tung oil is a standard article of commerce, as salable as is cotton and such commodities. The probabilities are that for the present generation, and possibly many years longer, land suitable to the growth of these trees will not supply the oil now used by North America. During 1934 there were imported into the United States from China 120,500,000 pounds of tung oil. Less than $\frac{1}{2}$ of 1 per cent of that amount was produced in the United States.



All tung trees planted the same day—April 1st, 1934. Trees in foreground uncultivated and planted in lespedeza sod. Trees in background cultivated. Neither plot received fertilizer nor cover crops.

USES OF TUNG OIL

It is claimed that approximately 100 articles of commerce may be made by combining this oil with other materials. New uses for the oil are rapidly being discovered, but its most extensive use is in the manufacture of paint and varnish. Spart Varnish is said to be the best on the market and is made from tung oil and resin, both of which may be grown here. In addition to paint and varnish, the following articles are a few of the many products manufactured by the use of tung oil: linoleum, oilcloth, oil bags, umbrellas, waterproofing materials, "rubber shoes," oil for dressing leather, printing inks, and textiles. The oil combined with aluminum is used for electric insulators and brake-lining for automobiles and railway trains.

Tung oil meal is a valuable nitrogenous fertilizer, approximately as valuable for fertilizer as is cotton seed meal.

LOCATION BEST SUITED TO TUNG TREES

We cannot state how far north these trees may be profitably grown, but the general opinion is that the industry is only economically profitable within fifty to seventy-five miles of the coast. We know, however, of no investigation showing that the growth of these trees is limited to such lines. It is generally known that severely cold weather is detrimental to tung trees. In our experimental work the last five years, there is no record of the trees being destroyed by low temperature, but tips of the tender wood have been killed. Temperature during this period has gone as low as 14 degrees F. It is possible that the trees may be grown profitably somewhat farther north than the area indicated.

OBJECT OF EXPERIMENTS

This has been to determine the best methods of growing at minimum cost the maximum amount of nuts of high oil percentage. In February of 1927 several tung trees were shipped to this Station and planted. The writer became connected with this institution in the fall of 1930. In 1932 seven acres of tung trees were planted in 12 different plots, each plot varying with methods of management. In 1934 approximately two additional acres were planted.

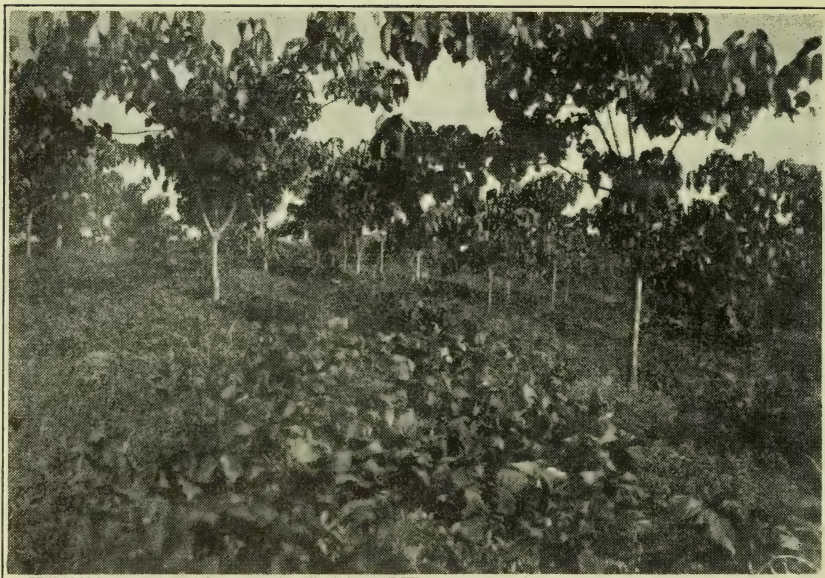
Five plots of our 1932 planting were on very hilly land which was cleared, plowed after the removal of stumps, and made into terraces. Terraces were given grade of approximately $2\frac{1}{2}$ inches per each 100 feet, and tung trees were planted on top. Trees were planted to conform to the contour of the land but in the main were from 18 to 25 feet apart.

No commercial fertilizer was used on the first five plots but the intertilled land was planted to summer and winter legumes, all legumes being turned under. The summer legumes varied in each plot, among those used being cow peas, soy beans, Florida beggar weeds and crotalaria. Winter legumes have been, in the main Autrain peas and Canadian field peas.

On plots 6, 7 and 8 was used 1 pound of fertilizer with varying analysis around each tree the first year and the amount increased 1 pound for each additional year's growth.

Plot No. 9 is a check plot—receiving no fertilizer—but is cultivated at the time of the planting of summer and winter legumes on the first five plots. Plot No. 10 was prepared for planting in the same manner as were all other plots but received no fertilizer and no culture other than the chopping, two or three times each year, for a radius of about 18 inches around each tree. Plot No. 11 consisted of trees planted around the fence. The amount and the nature of fertilizer used varied.

Plot No. 12—spacing experiment—with trees planted 10 to 30 feet apart, cultivated and planted to soy beans and crimson clover. Plot No. 13 was cultivated but received no fertilizer nor cover crops. Plot No. 14 was in lespedeza sod and adjacent to plot No. 13 and had no fertilizer nor cultivation. These are seen in the photograph on page 12, and from results obtained no one can doubt the wisdom of cultivating these trees.



Three year old trees at South Mississippi Branch Experiment Station cultivated and grown with soy beans.

CONCLUSIONS DRAWN FROM INVESTIGATIONS

The writer has reviewed tung oil plantings from Florida to Texas, has seen most of the orchards along the Gulf Coast in states east of the Mississippi river, and has observed very closely tung trees grown, especially those in this, Pearl River County, and at this State Experiment Station. While there are many phases of the industry that have not been definitely determined, the following facts seem evident.

(1) The economic growth of tung trees does not differ materially from that of most other plants and the financial returns obtained from their growth will depend upon the care and attention given the trees. This attention includes use of suitable land—slightly acid and at least fairly productive—and the addition of legume cover crops and other fertilizer when needed. The selection of seedlings and their proper transplanting with subsequent care are very important.

(2) In transferring the year old seedlings from the nursery, great care should be taken. The tap-root should be left from 12 to 15 inches long and lateral roots replaced in the soil as nearly as possible in the position they were found in the nursery. This necessitates carefully sifting soil between the roots and firmly packing it to avoid formation of air-pockets. Top soil and if possible some decayed vegetation should be used in the refilling of the holes when the trees are planted. These trees are planted not for a month or a year, but for 20, 40, 60 or more years. A tank of water hauled by a wagon or truck may be siphoned out to aid in settling the dirt around the young trees and thus good growth is insured. The seedlings should be pruned 6 to 8 inches from the ground. It is unreasonable to expect only a part of the root structure in a recently transplanted plant, to collect and furnish food for the whole tree in its new en-

vironment. Leave the most vigorous bud that appears near base of the pruned tree and rub off all others as they appear. This bud, within 10 or 12 months will develop into a vigorous body of the new tree that will be erect and will branch at the proper distance—3 to 5 feet—from the ground.

(3) The average farmer should begin in a small way with a few trees and possibly with one to five acres. These trees, placed not less than 30 feet apart in either the square or triangular method, should be planted on the best land obtainable and should be cultivated. The soil should be intertilled with any field crops, one of which either in winter or summer should be a legume, this being turned under when matured.

(4) These trees should be cultivated particularly during the early years of their growth. This is not a reforestation problem. One should not plant a larger acreage than can be properly cultivated. The problem that should most interest one is the financial returns which may be reasonably expected from land planted to tung trees. Many thousands of acres have been planted to this crop and little or no care and attention given them after planting. Such plantings will never pay for the work that has been done, and it is unreasonable to expect profit from such methods.

(5) In 1935 Pearl River County produced 1500 bales of cotton. The highest estimate that could be made for the cash value of this crop would be approximately \$112,000.00. At the present time it has tung oil plantings exceeding 30,000 acres. If these trees were properly cared for we could

SOUTH MISSISSIPPI BRANCH EXPERIMENT STATION Tung Tree Investigations

Plot	Summer Cover Crop	Winter Cover Crop	Fertilizer	Avg. Height 1933	Diam. at Crown 1933	Avg. Height 1934	Diam. at Crown 1934	Avg. Height 1935	Diam. at Crown 1935
* 1	Cow peas	Aust. Peas	None	8.75	1.9	10.05	2.8	13.60	4.0
2	Soy beans	Canadian F. P.	None	7.65	2.0	9.00	3.1	13.90	3.8
3	Fla. Beg. Wd.	Crim. Clover	None	6.75	1.65	8.50	2.5	12.80	3.3
4	Crot. (Specta.)	Vetch	None	6.00	1.25	7.40	2.2	11.70	2.9
5	Crot. (Specta.)	Vetch	None	4.50	1.25	6.25	2.1	9.50	2.8
6	None	None	(Com. Fert. of	6.90	1.75	8.90	2.7	12.30	3.7
7	None	None	Var. Analysis)	5.90	1.50	7.60	2.3	11.80	2.9
8	None	None	"	7.70	2.25	9.70	3.6	12.80	4.0
9	Check	Check	None	5.00	1.30	6.30	1.8	9.50	2.7
10	No Cultivation	None	None	4.90	.75	5.60	1.1	6.10	1.6
11	No Cultivation	None	Var. Analysis	5.20	1.65	6.70	2.6	11.00	3.1
12	Soy beans	Crim. Clover	None	6.50	1.42	8.50	3.0	10.80	3.9
**13	Planted 4/1/34	Cultivated	None			5.00	1.8	10.70	2.9
14	Planted 4/1/34	No Cultivation	None			3.00	1.0	3.48	1.12

Plots Nos. 1 to 5 inclusive have had no commercial fertilizer. These plots were cultivated and legumes turned under.

Plots Nos. 6 to 8 inclusive were cultivated and fertilized. No cover crops used.

Plot No. 10 was thoroughly prepared before planting, but has not been cultivated since, other than chopping around the trees for a radius of about 18 inches.

Plot No. 11 planted around the fence and not cultivated. Com. Fert. & Stable manure applied in series of 5 trees each. Plot 12—Spacing test. Plot 13 was cultivated, with no fertilizer. Plot 14 received no fertilizer or cultivation.

*Plots Nos. 1 to 12 inclusive were planted March 31st, 1932.

**Plots Nos. 13 and 14 were planted April 1st, 1934.

Records of diameter and height were obtained in the Fall of each year.

reasonably expect a cash return of \$1,500,000 per year. There are trees now being grown in other South Mississippi Counties. They can, doubtless, be profitably used in some sections where they have not yet been planted.

TUNG TREE PLANTINGS IN THE UNITED STATES

At a recent tung oil committee meeting of the Farm Chemurgic Council held at Beaumont, Texas, October 21st, 1935, the estimated plantings now in existence in the Southern States were reported as follows:

Alabama	3,000 acres
Florida	17,000 acres
Georgia	3,500 acres
Louisiana	4,000 acres
Mississippi	43,000 acres
Texas	4,500 acres
	75,000 acres

PREVENTION OF CROP DISEASES AND INSECT PESTS

Nemitode disease, cotton wilt, cotton boll weevil, mosaic disease of sugar cane, grain weevil work and other insect pests have received considerable experimental investigations at this Station. Many of these diseases and the damages caused by various insect pests can be prevented by growing disease resistant varieties of crops, others by the use of sprays and dusting materials.

VARIETIES OF FARM PRODUCE

One of the most important lines of work being done at the Station consists of investigations made with varieties of farm and garden plants. We have grown 29 varieties of corn, 30 varieties of cotton, 14 varieties of satsumas, 60 of cane, 20 of crotalaria and numerous varieties of other legumes, pecans, brambles, vegetables and cereals. Among the corn varieties we are using such prolific strains, as Hastings and Cocke's prolific. Leguna corn has been found to be one of the best varieties for late planting.

During the last several years we have grown Leguna corn following the harvesting of oats. This corn has been planted on an average between the first and fifth of June and has give us excellent results. Rye is one of the best cereals for winter cover crops. It has a very dense and fibrous root system and when turned under adds considerable vegetation to the soil. Abruzzi rye, common rye, and rustproof oats are sown for winter cover crops on all land not occupied by winter legumes, except on plots growing other plants and on those left bare as a part of our program for the specific project under investigation.

Horticultural Work

The County Home Economic Agent with her district leaders and about 60 4-H club girls have visited our garden crops and seen the results obtained by seasonable plants of the all-year-around garden. The spring garden consisted of growing tomatoes of seven varieties; namely, Break O'day, Livingston, Norton wilt resistant, Stone, Marglobe, Peerless June pink and Gulf State Market. Of strawberry plants we have eight varieties; Southland, Big Joe, Lupton, Mastodon everbearing, Chesapeake, Blakemore and Dorsett. Other horticultural plots include investigations with the Hiley and Belle of Georgia peaches, figs, several varieties of pecans, blueberries, Youngberries, raspberries, dewberries and blackberries. In the spring garden have been grown asparagus, beans, bush lima, bush snap and pale snap beans, beets, cabbage, carrots, cantaloupe, collards, sweet corn, lettuce, okra, mustard, onions, parsley, peas (English and Crowder), pepper (Bell and Cayenne), spinach, potatoes (sweet and Irish), squash, tomatoes, turnips and watermelons. For fall garden are grown bush, snap and lima beans, cabbage, carrots, mustard, onions, tomatoes and turnips.

TOMATO VARIETY TEST 1935

Fertilizer used, 1,000 pounds of 6-8-4 commercial fertilizer per acre.

	Pounds per acre
Break O'day	7533
Livingston	6324
Norton Wilt Resistant	7494
Stone	8820
Marglobe	7398
Peerless June Pink	8202
Gulf State Market	6954

CONTROL OF SPINACH "DISEASE"

Spinach has been grown extensively in certain sections of South Mississippi, particularly, in areas near canning factories. In 1933 the president of a factory, canning large quantities of spinach, brought to the Station a problem very seriously affecting the growth of this crop. For want of a better term this so-called condition has been designated "damping-off disease." In attacking it we assumed the condition was probably due to excessive acidity or to the lack of potash to balance the other plant food.

Experiments were planned in 1933 in which a series of plots were treated with potash and others with lime in varying amounts. Check plots were left adjacent to soils that had been treated with potash and those with lime. The first year's work indicated clearly that there was a marked deficiency of lime for the normal growth of spinach. Examination of these station plots by the official who brought this problem to the Experiment Station convinced him that the soil needed to be rendered less acid. Check plots of spinach—those receiving no lime—produced little or no growth, while the addition of lime corrected the extreme acid condition and normal crops of spinach were produced.

In 1933, the first year of this work, soil receiving no lime had pH value of 5.2, and produced only 104 pounds of spinach per acre. That treated

with 1,000 pounds of lime, thus bringing the pH value to 6., produced 360 pounds. Adjacent plots treated with 2,000 pounds of lime had a pH value of 7.4 and produced 312 pounds of spinach per acre. Other adjacent plots upon which were used 3,000 pounds of lime caused pH value of 8., and produced 1,488 pounds of spinach per acre. This crop was planted April 6th which probably caused low production.

In 1934 spinach was planted March 17th and replanted April 24th, which proved too late for satisfactory records. During the last two years it has become a common practice for spinach growers who have had this failure to apply lime in liberal amounts, which they claim has corrected this serious condition.

We give below our 1935 record.

SPINACH LIME TEST, 1935

1,000 pounds of 6-8-4 commercial fertilizer were used on all plots except where ammo-phos was applied, on these plots we used 1,000 pounds of 4-8-4, 4-10-4, 4-12-4 commercial fertilizers.

	Pounds per acre
4-8-4 Ammo-phos	1597.5
6-8-4 2,000 pounds lime	1725.3
6-8-4 1,000 pounds lime	511.2
6-8-4 Check	319.5
4-10-4 Ammo-phos	511.2
6-8-4 1,500 pounds lime	1043.7
4-12-4 Ammo-phos	830.7
6-8-4 Check	404.7



Tomato Varieties.

GRAPE WORK IN COOPERATION WITH THE U. S. DEPARTMENT OF AGRICULTURE

This work was begun in 1932 and was designed to include investigations of grape stock varieties; test of scions grown on their own roots and on the

stocks of other varieties; vineyard management as to trellising; the use of fertilizer, cover crops, spraying, pruning and cultivation. One of the most important lines of work has been to discover stocks best suited to the growth of scions from grapes of proven merit in this section.

This work was begun with ten vines each of 41 stock varieties, which were shipped to this Station from California. Thirty other varieties produced from local cuttings were also used, 4 of which had shown superior merits when grown on their own roots. Two of the above 30 varieties were found in the woods nearby.

Of the 41 stock varieties imported, 4 have to date shown marked superiority in adaptability to this section; namely, Dog Ridge, Ramsey, Barnes and Australis. On each of these four varieties grafting and budding of our best local table varieties have been made.

This grape work is being continued and a special bulletin will be issued concerning it when the project is completed.



Vineyard.

HOME VEGETABLE GARDENS

For The

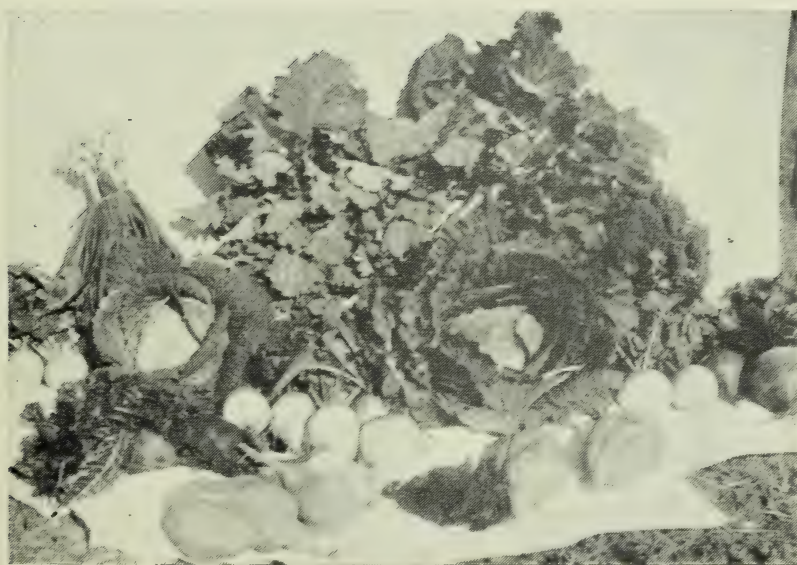
YAZOO-MISSISSIPPI DELTA

Delta Experiment Station

Stoneville, Mississippi

By

E. A. Currey



Green vegetables harvested from Yazoo-Mississippi Delta garden January 15. Turnips, cabbage, beets, spinach, kale, collards, and onions.

MISSISSIPPI AGRICULTURAL EXPERIMENT STATIONS

State College, Mississippi

J. R. RICKS, Director

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DELTA HOME VEGETABLE GARDENS

By E. A. Currey*

INTRODUCTION

The home vegetable garden is an integral part of a live-at-home program. It permits a wide adaptation in the choice of vegetables which would not be accessible, or else very expensive. The low cost at which vegetables can be produced in the home garden gives to it the rank of first importance as a source of quality vegetables. Since vegetables have been recognized as the chief source of the health giving and growth promoting vitamins so essential in the diet of both young and old, the value of a home garden is more fully appreciated. Home grown vegetables can be gathered fresh and be of best quality.

SIZE OF GARDEN

The size of the garden is determined by the size of the family, the quantity of vegetables consumed, the quantity needed for canning or storing, and the amount of available land. The garden should be long and narrow with rows sufficiently wide to permit cultivation with horse-drawn implements. On a quarter-acre garden of this type, a person with ordinary experience can grow enough vegetables for a family of five. If proper succession of crops is employed, a quarter-acre garden will furnish vegetables for more people.

PLAN AND ARRANGEMENT

Every garden should be well planned before planting time. This is best done by measuring the garden and making a plan of it on paper. The family's tastes should determine the vegetables to be chosen. The better liked vegetables should form the basis of the garden, with a few unusual ones included for variety. In locating the various vegetables in the garden, due consideration should be given to "succession" in order that the land may be occupied at all times.

If the vegetables are properly chosen as many as three successive crops may be grown on the same land in one year. The perennials, such as asparagus and the brambles, should be planted on one side of the garden.

SEED

Many garden seeds lose their vitality in one year, hence fresh seed should be obtained from a reliable source each year. In selecting seed the important things to know are the amount required, and the variety best adapted to Delta conditions. The grower should demand the variety best suited to his particular need and not buy just turnip, carrot, or cabbage seed. Since seed is a small part of garden cost, the best should be demanded and enough planted to insure a good stand which may be thinned later as desired. The seed of vegetables too tender for direct early field planting may be planted in boxes or hotbeds and the plants transferred to the garden at the desired age. If plants are purchased, the same care should be exercised in selecting them as stated for seed.

PREPARING THE SEED BED

The garden should be disked in the fall, flat broken six inches deep, disked again, and bedded. Winter freezing and thawing will pulverize the soil. The fall garden should be prepared at least three weeks before the seed or vegetables are planted, in order to have a firm seed bed. The seed bed should be well pulverized on top and firm underneath at the time of planting. In the spring it should be harrowed well and the seed planted on the beds. If barnyard manure is to be used it should be well scattered over the ground before plowing in the fall. A layer from three to four inches deep is not too much, if the garden is low in organic matter. If manure is not used, 800 to 1000 lbs. of commercial fertilizer (Nitrogen only) should be applied and harrowed into the soil two or three weeks before the vegetables are planted.

***Acknowledgements:** The author wishes to express his appreciation to Mr. W. E. Ayres, Assistant Director in charge of this Station, for constructive criticisms and helpful suggestions at all times; and to Mr. D. W. Grimes, now of the State Plant Board, who did the Delta Station horticultural work in 1926 and 1927.

CULTIVATION POINTERS

Frequent shallow cultivation should be employed for most garden crops. By keeping the surface soil well stirred a moisture-conserving mulch is formed. Cultivation also kills the weeds and grass that rob the vegetables of plant food, moisture and sunlight, and aerates the soil so that beneficial soil bacteria will have favorable conditions under which to work. Every garden should be cultivated at least once a week during the growing period. Grass and weeds are easiest destroyed when they are very small. The garden should not be cultivated when either the soil or plants are wet. Cultivating wet soil produces clods; disturbing wet plants spreads disease.

HOTBEDS AND COLD FRAMES

Early plants are usually started in a hotbed. The hotbed consists of an inclosure covered with glass or other transparent or translucent material and supplied with some source of heat, usually fermenting barnyard manure, to promote growth. It is best located on the south side of a building near some frequently used path where it can be attended without interfering with other work. It should always face the south.

A manure hotbed is all that is necessary for the average home garden. This can be easily constructed at little expense from materials found on the farm. A well drained spot should be selected and a pit 24 to 30 inches deep and 6 feet wide dug. The ends and sides above ground should be made of 2-inch cypress boards supported by stakes driven into the ground. During January or early February this pit should be filled with manure mixed with straw or stable rubbish to a depth of 24 to 26 inches. This should be well packed and watered. Six inches of well pulverized and very rich loam or sandy loam soil should be placed on top of the manure. Glass or other cover should be immediately placed over the hotbed. The seed should be planted in about two weeks. The plants must be ventilated and carefully watered regularly. Two or three weeks before planting in the field, they should be transplanted from the hotbed to a cold frame.

A cold frame is the same as a hotbed except that it does not have any form of artificial heat and may be covered with waterproofed muslin. The plants should be set from 2 to 4 inches apart in the cold frame so that good root systems can develop. The cold frames should get plenty of ventilation and the plants be allowed to harden therein for two weeks before planting in the garden. Reducing soil moisture aids materially in hardening the root system. During warm clear weather late afternoon is the best time for transplanting to the garden. If the ground is dry the plants should be kept watered for three or four days after transplanting.



Bush bean variety test.

YIELDS AND CULTURAL HINTS

ASPARAGUS: Asparagus can be grown on almost any well drained soil but does best on a deep, mellow, sandy loam. There is little possibility of having the land too rich. Well rotted barnyard manure should be liberally applied before the plants are set. Large one or two year-old crowns are best. They should be planted about six to eight inches deep either in the fall or early spring. Edible spears should not be cut the same year the plants are set and not all of them the second and third years. After that time the bed should be well established, and, with proper fertilization and care, it should last 10 or more years. When the shoots become tough and stringy, the cutting should be discontinued and the tops allowed to grow until frost. When the tops are killed by frost, they should be removed and burned. It is best to apply a good mulch of leaves or well rotted manure to the bed at this time.

BEANS: Beans should not be planted until all danger of frost has passed and the ground has warmed up. Successive plantings can be made at intervals of ten days or two weeks from April 1 until June 1, and again from August 15 until September 15.

Both green podded and wax podded varieties of bush snap beans are available. In general, green podded varieties are most satisfactory. Over a period of eight years Bountiful averaged 2,315 lbs. of beans per acre, annually; Tennessee Green Pod, 3,027 lbs.; Burpees Green Pod, 2,215 lbs.; Giant Stringless Green Pod, 1,670 lbs.; Pencil Pod Black Wax, 1,661 lbs.; Curries Rust Proof Wax, 2,809 lbs.; and Improved Golden Wax, 1,583 lbs. Tendergreen has not been tested over this long period but yields around 6000 lbs. per acre. (See table 1, page 16, for variety suggestions.) Bush varieties are planted in 24 to 36 inch rows, spaced about 4 inches in the drill, and covered at least one inch deep. Frequent shallow cultivations are suggested for all beans.

Pole beans require somewhat richer soil than does the bush type. They should be planted in hills 3 ft. apart in 40" rows with two to three plants to the hill. A stake at least 5 ft. high should be placed beside each hill before the climbing stems appear. Canes stuck deeply into the ground so that they cross at the top may also be used as stakes. For seven years White Creaseback averaged 5,282 lbs. per acre annually; Kentucky Wonder, 5,784 lbs.; and Cornfield, 8,492 lbs. For two years McCaslan averaged 5,935 lbs. per acre.

Lima beans cannot be successfully grown on poor soil. They should not be planted until the soil becomes thoroughly warm. Bush Limas should be seeded in rows 3 ft. apart, and the plants spaced 4 to 6 inches in the row. A two year average yield of Jackson Wonder was 10,618 lbs. per acre; of Henderson, 3,185 lbs. per acre. Fordhook, Burpees Bush Lima, New Wonder, and other varieties have been grown in Station variety tests but failed completely.

Pole Limas should be planted in every home garden. They do not produce well when crowded. The rows should be spaced at least 4 ft. apart and the hills 5 ft. apart in the row. They should be staked as described above or by stretching hog wire fencing along the rows before the runners appear on the vines. Carolina Pole Lima yielded 20,654 lbs. per acre in 1935 and Florida Speckled, 17,623 lbs.

EDIBLE SOYBEANS: Over a hundred varieties of edible soybeans have been tested at this Station. Two very outstanding varieties (Nanda, a yellow bush variety and Chame, a brown viny type) have been found which averaged 40 bushels of dried beans per acre for the past two years. Six other varieties are yielding well and have good qualities. If edible soybeans are to be eaten green, they should be picked when the pods are well filled but before they begin to yellow. These pods should be covered with boiling water for two minutes, taken out, and the beans shelled. Scalding makes shelling easy. They should be cooked and seasoned the same as green shelled peas or lima beans. If they are to be eaten as dry beans, they should be soaked in water over night before being cooked. They should be seasoned the same as dried peas, Pinto beans, or Lima beans and cooked for two hours.



Pole lima beans staked with canes.

BEETS: Beets may be sown very early since the plants withstand light frosts. Since the seed balls contain more than one seed, more than one plant usually develops from each so-called seed. Beets grow best in a loamy soil which has been liberally fertilized. They require, for best development, an abundant supply of plant food and moisture. The seed bed must be well prepared in order to obtain a good stand. At this Station the Early Wonder variety averaged 2205 lbs. per acre; Early Eclipse, 2363 lbs.; and Detroit Dark Red, 1727 lbs. for 3 years.

CABBAGE: Cabbage plants are very hardy. They will withstand most Delta winters if planted in September or set in early October. If the seed are not planted in the garden in September, they should be planted as soon as possible in the spring. Plants should be transplanted to the garden in February. All Head Early has averaged for 3 years, 24,502 lbs. per acre. Succession, 23,518 lbs.; All Seasons, 23,434 lbs.; Early Flat Dutch, 26,790 lbs.; Surehead, 19,077 lbs.; Early Jersey Wakefield, 13,776 lbs.; Copenhagen Market, 13,771 lbs.; and Charleston Wakefield, 11,236 lbs. Early Jersey Wakefield splits very badly if not cut as soon as the heads are hard. For very early heads Copenhagen Market is better than Early Jersey Wakefield. Insects and diseases must be watched closely and controlled as soon as found. They are discussed on pages 18 and 19.

CANTALOUPE: Cantaloupes require high temperatures and plenty of sunlight for high quality fruit. Seed should not be planted until danger of frost is over. If planted earlier, protection must be given with paper or other covers. Ten or more seed should be sown in each hill, and the plants thinned to two or three when the fourth leaf develops. It is best to prepare beds 6 or 7 ft. wide and space the hills 6 or 7 ft. apart on them. A bushel or more of well rotted manure per hill should be thoroughly worked into the soil a week or ten days before the seed are planted.

Good cultivation should be maintained until the vines interfere. Cantaloupes require a great deal of moisture especially at the time of fruiting. About 10 fruits per plant may be expected under favorable conditions. When the fruit ripens it turns yellowish and a crack forms around the base of the stem where it joins the fruit.

In production in tons per acre, at this Station, for 8 years Extra Early Hackensack led with an average of 9.5 tons; Tip Top Nutmeg, 6.8 tons; Rockford, 5.9 tons; Eden Gem, 4.3 tons; Emerald Gem, 4.0 tons; and Hale's Best, 2.1 tons. Rockford adapted itself to varying conditions and held its quality better than any of the other varieties. Extra Early Hackensack and Tip Top Nutmeg are good varieties, but during rainy spells at the ripening season burst and rot badly even before ripening.

CARROTS: Carrots should be planted only in a well prepared seed-bed. A crust should not be allowed to form before the seedlings are up. The carrot is becoming more popular as a home garden vegetable because of its value in the diet. For best quality, they should be pulled when about one inch in diameter at the crown.

SWEET CORN: Sweet Corn should be planted March 15 and every two weeks thereafter until July 15. Corn loses its sweetness rapidly after it is harvested; therefore it should be pulled only as needed.

Over a period of seven years Trucker's Favorite averaged 4439 lbs. of corn, shuck and cob included; Early Adams, 4382 lbs.; Mammoth Sugar, 3813 lbs.; Country Gentleman, 3654 lbs.; Golden Bantam, 1733 lbs.; and Golden Hummer, 1096 lbs. per acre. Honey June has been in the tests only two years but averaged 9765 lbs. those two years. (During those same two years Country Gentleman averaged 8457 lbs. and Golden Bantam 3258 lbs. per acre.) Its quality is extra fine. It is not attacked by corn ear worm as badly as any of the other varieties.

CUCUMBERS: A few hills, if well cared for, will furnish enough cucumbers for canning and table use during the summer. The crop does well in loam soils and can be planted either in hills 4 feet apart each way or in 7 ft. rows and thinned to 24 to 30 inches in the row. Cucumbers are perhaps somewhat more susceptible to cold injury than cotton and hence should not be planted until safe cotton planting time. The plants must be given careful attention to prevent damage from insects and diseases. Cucumbers should be gathered daily or every two days for best pickles. Frequent shallow cultivations are necessary while the plants are young. In 1935 Stay's Green yielded 21,635 lbs. per acre; Longfellow, 19,341 lbs.; Clark's Special, 19,166 lbs.; White Spine, 18,905 lbs.; Davis Perfect, 16,582 lbs.; and Early Fortune, 16,146 lbs. of fruit per acre averaging 3 inches long.

EGGPLANTS: Eggplants are grown like tomatoes, except that they are more sensitive to cold and other adverse conditions and must be handled more carefully. The seed should be planted in a hotbed the latter part of February and handled just like tomato plants. They are harder to transplant successfully and should be well cared for at that time. They should be well cultivated to keep the plants growing rapidly. Unfermented vegetable matter should not be used as a fertilizer for eggplant. New York Purple variety averaged 18,150 lbs. per acre; Black Beauty, 19,470; and Florida High Bush, 37,680 lbs. over a 3-year period.

LETTUCE: Lettuce is a very popular salad vegetable and should be in every home garden. It is a cool season crop and cannot be made to head during hot weather. It is best to sow the seed rather thickly in the row. When the plants are about two inches high, they should be thinned to 6 or 8 inches. Fall planting is better than spring planting if heads are to be produced. If the seed are planted from the middle to the last of September the heads will be formed in December or January. Leaf varieties can be planted in January and February. They will seed rather than head when hot weather comes. New York is by far the most outstanding variety for heads or leaves. It averaged 30,311 lbs. per acre over a period of five years while Improved Hanson averaged 21,889 lbs.; Summer All Head, 13,704 lbs., Crisp as Ice, 11,144 lbs.; and May King, 7079 lbs. Mignonette has been in the test only two years and averaged 1815 lbs.

WATERMELONS: Watermelon cultivation is practically the same as for cantaloupes. The plants grow much larger and require more space. The soil should be more sandy for watermelons than for cantaloupes and equally fertile. They should be spaced ten feet between hills and ten feet between rows. One to two plants should be left in each hill. Plants must be protected from the cucumber beetle until the foliage becomes toughened.

Stone Mountain is the most outstanding watermelon for home use. It has an excellent sweet flavor and ripens close to the rind. It averaged 16.4 tons per acre and 13.4 lbs. per melon here over a period of eight years. Halbert Honey is next best for home use. It has a very sweet flavor, is a few days earlier than Stone Mountain, ripens very close to the rind, and is a good shipper. It averaged 15.5 tons per acre, and 11.4 lbs. per melon here over an 8 year period. Bradford averaged 16.7 tons per acre, and 11.2 lbs. per melon; Tom Watson, 16.7 tons per acre and 13.9 lbs. per melon; Thurmond Gray, 16.2 tons per acre and 14.3 lbs. per melon; Kleckly Sweet, 14.9 tons per acre and 11.9 lbs. per melon; and Florida Favorite, 12.1 tons per acre and 10.4 lbs. per melon. Bradford and Tom Watson have good shipping qualities and yielded more than Stone Mountain and Halbert Honey but their flavor was inferior.

ONIONS: A rich loam soil containing plenty of humus is best suited to the production of onions. After the soil has been well pulverized and leveled off the onion seed should be drilled in rows 24" to 26" wide, about September 25th. In February the plants should be thinned to 4 inches in the drill. The extra plants can be eaten or sold for transplanting. Onions require frequent shallow cultivations. Onion seed may be used for fall plating, but only plants or sets should be used for the February planting. Seed planted in September produce better onions and higher yields than plants or sets do if planted in the spring. Over a period of seven years Yellow Danvers averaged 6852 lbs. per acre; Silver Skin, 6455 lbs.; Crystal White Wax, 6326 lbs.; Australian Brown, 5974 lbs.; Red Wethersfield, 5779 lbs.; White Globe, 5559 lbs.; Prize-taker, 4928 lbs., and Yellow Bermuda, 4166 lbs. per acre. The Sweet Spanish has been tested for only one year but, because of its generally recognized good keeping qualities, is excellent for home gardens. Prizetaker ranks second in keeping qualities.

PEAS: Garden peas require good drainage. The land should be prepared well and wrinkled varieties planted about March first. Smooth varieties, if used, should be planted 2 or 3 weeks earlier. The seed should be sown in double rows about six inches apart so two rows can be staked at one time. The double rows should be 36" apart. The staking may consist only of wire netting stretched between the double rows. Cultivation should be clean and shallow. Little Marvel is the best early variety in yield and quality. It averaged 1152 lbs. peas per acre over a period of four years. Dwarf Telephone or Daisy is the best medium early variety. It averaged 1008 lbs. per acre. Luscious Sugar is the best late variety. It averaged 1287 lbs. per acre. Bliss Everbearing averaged 1058 lbs. per acre, Telephone, 593 lbs., and White Marrowfat 405 lbs. per acre. Garden peas must be planted early enough to permit fruiting before hot weather.

PEANUTS: Over a period of six years Virginia averaged 3699 lbs. of peanuts per acre; White Spanish, 2803 lbs.; Valencia, 2196 lbs.; and Tennessee Long Red, 1976 lbs. This is a field crop but is also adapted to vegetable gardens for home use.

PEPPERS: Pepper seed should be planted in a hotbed in February, and transplanted to the garden as soon as the ground warms up. It should be grown in the rows 3 ft. apart and about 18 inches apart in the row. It should be transplanted, cultivated and harvested about the same as the tomato. Over a period of seven years the varieties averaged, in lbs. per acre, as follows: World Beater, 16,858 lbs.; Ruby King, 16,843 lbs.; Chinese Giant, 14,236 lbs.; Royal King, 12,958 lbs.; Long Red Cayenne, 11,290 lbs.; Bull Nose, 10,413 lbs.; Tomato Salad, 8543 lbs.; and Pimento, 7343 lbs. California Wonder has been in the test only two years but averaged 13,231 lbs. per acre. (During the same two years Chinese Giant averaged 11,689 lbs. and Ruby King, 13,377 lbs. per acre.)

IRISH POTATOES: Irish potatoes do best on a good loam soil which contains an abundance of humus and plant food elements and has good drainage. For 7 years the unfertilized plots averaged 93.9 bu. per acre; phosphorous and potash, 97 bu.; phosphorous alone, 106.3 bu.; nitrogen and potash 133.6 bu.; Nitrogen and Phosphorous, 153.8 bu.; Nitrogen alone, 126 bu.; Nitrogen, phosphorous, and potash, 157 bu. In these tests Nitrogen was used at the rate of 45-lb per acre (equal to 225-lb of 20% nitrogenous fertilizers); phosphorous 45-lb (equal to 225-lb of 20% superphosphate); and potash 30-lb (equal to 60-lb of 50% Muriate of potash) per acre. Nitrogen gave consistent increases in the yield of potatoes whether it was used alone or in combination with the other elements. Phosphorous gave significant increases in yield only when it was used in combination with nitrogen. Potash failed, in the combinations used, to significantly increase the yield of potatoes.

About the middle of February shallow furrows should be laid off about 36" apart and the potatoes dropped twelve inches apart with the cut surface down. These potatoes should be covered with a turning plow or buster. When the first sprouts appear above the ground, the beds should be harrowed crosswise with a light section harrow. Frequent shallow cultivations should be given until the ground begins to crack from the growth of the tubers. When the vines die the potatoes should be dug. It is best to keep the potatoes out of the sunshine as much as possible. They should be stored in a cool, dry, well ventilated place by spreading them out and covering them with straw until cool weather. They may then be stored in a cellar or kept wherever they will not freeze. The ideal storage temperature is 40° Farenheit. For five years Warba averaged 149 bu. per acre; Triumph, 129 bu.; Early Ohio, 94.2 bu.; Katahdin, 132 bu.; and Burbank, 94 bu.



Irish potato fertilizer test showing plot treated with phosphorous and potash in foreground and nitrogen alone in background.

SWEET POTATOES: A sandy soil is best for sweet potatoes. A well drained loam soil can be used. The land should receive a broadcast application of 300 to 400 lbs. of a commercial nitrogen fertilizer, and be disked, and bedded in 3-foot rows in February. The beds should be left alone until the plants are ready to set in early April. They should be re-bedded and harrowed with a light harrow lengthwise the rows, and the plants set at intervals of 10 to 12 inches. In order to get early plants, sweet potatoes should be bedded in a hot bed during the latter part of February. Under average conditions plants will be ready to pull by early April. It is necessary to keep the cold rains off the bedded potatoes in order to get a stand of slips. Re-planting should be done until a perfect stand is secured. Clean cultivation is essential. Frequent shallow cultivations are necessary until the vines cover the ground. The vines subsequently shade the ground and smother all small grasses and weeds.

Sweet potatoes should be dug just before the vines are nipped by frost. They should be dug on a bright, drying day, if possible, and when the ground is relatively dry. They should be handled almost as carefully as eggs and put into curing the same day they are dug. Curing should be done at between 85° and 95° F. for a period of ten days or two weeks with a free circulation of air. After curing, the temperature should be reduced to between 40° and 50° F. for storage. Sweet potatoes should be handled as little as possible after digging and especially after they have been cured. For more detailed information write for latest Farmers' Bulletin of the United States Department of Agriculture on Sweet Potato Growing.

For 8 years at this Station, Porto Rico, without fertilizer, averaged 226 bu. per acre; with phosphorous and potash, 264 bu.; with nitrogen and potash, 336 bu.; with nitrogen and phosphorous, 336 bu.; with nitrogen alone, 336 bu.; and with nitrogen, phosphorous, and potash 343 bu. per acre. In these tests nitrogen was used at an average rate of 45lb (equal to 225 lb of 20% nitrogenous fertilizer); phosphorous, 45lb per acre (equal to 225 lb of 20% superphosphate); and potash, 30lb (equal to 60lb of 50% potassic fertilizer) per acre. None of the constituents except nitrogen have been profitable on sweet potatoes. In variety tests the same eight years, Porto Rico led with an average of 299 bu. per acre; Triumph, 278 bu.; Gold Coin, 272 bu.; Nancy Hall, 188 bu.; Yellow Yam, 154 bu.; and Southern Queen, 152 bu. The variety tests were not planted on the same kind of soil as the fertilizer tests in 1930 and 1931. This accounts for the low yields in the variety tests.

No appreciable difference has been found over a period of 8 years in the per cent shrinkage in storage or in the curing qualities of the different fertilizer treatments. There is quite a difference in the per cent shrinkage of the varieties. Over an 8 year period the average per cent shrinkage during curing and storage of the different varieties has been as follows: Gold Coin, 22%; Yellow Yam, 18%; Nancy Hall, 14%; Southern Queen, 13%; and Porto Rico, 12%.



Sweet Potato Fertilizer Test represented by actual yields of potatoes in 1935. Reading from left to right: nitrogen, phosphorous and potash, 330 bu. per acre; no fertilizer, 208 bu.; nitrogen and phosphorous, 307 bu.

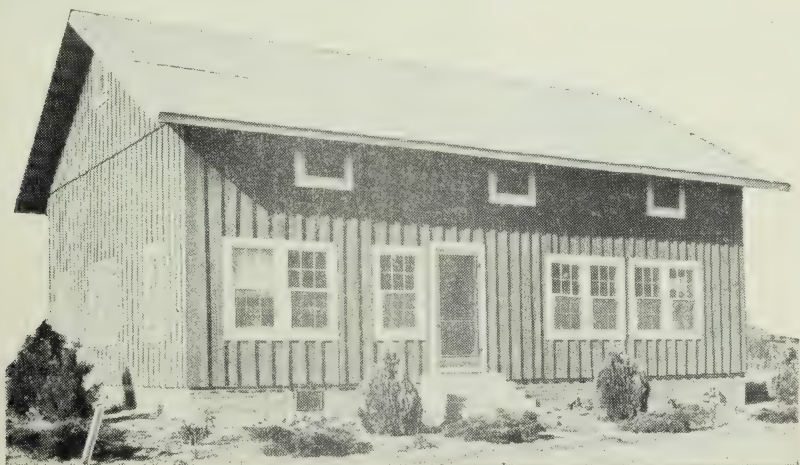


Sweet Potato Fertilizer Test represented by actual yields of potatoes in 1935. Reading from left to right: phosphorous and potash 208 bu. per acre; nitrogen alone 344 bu.; and superphosphate alone 213 bu.

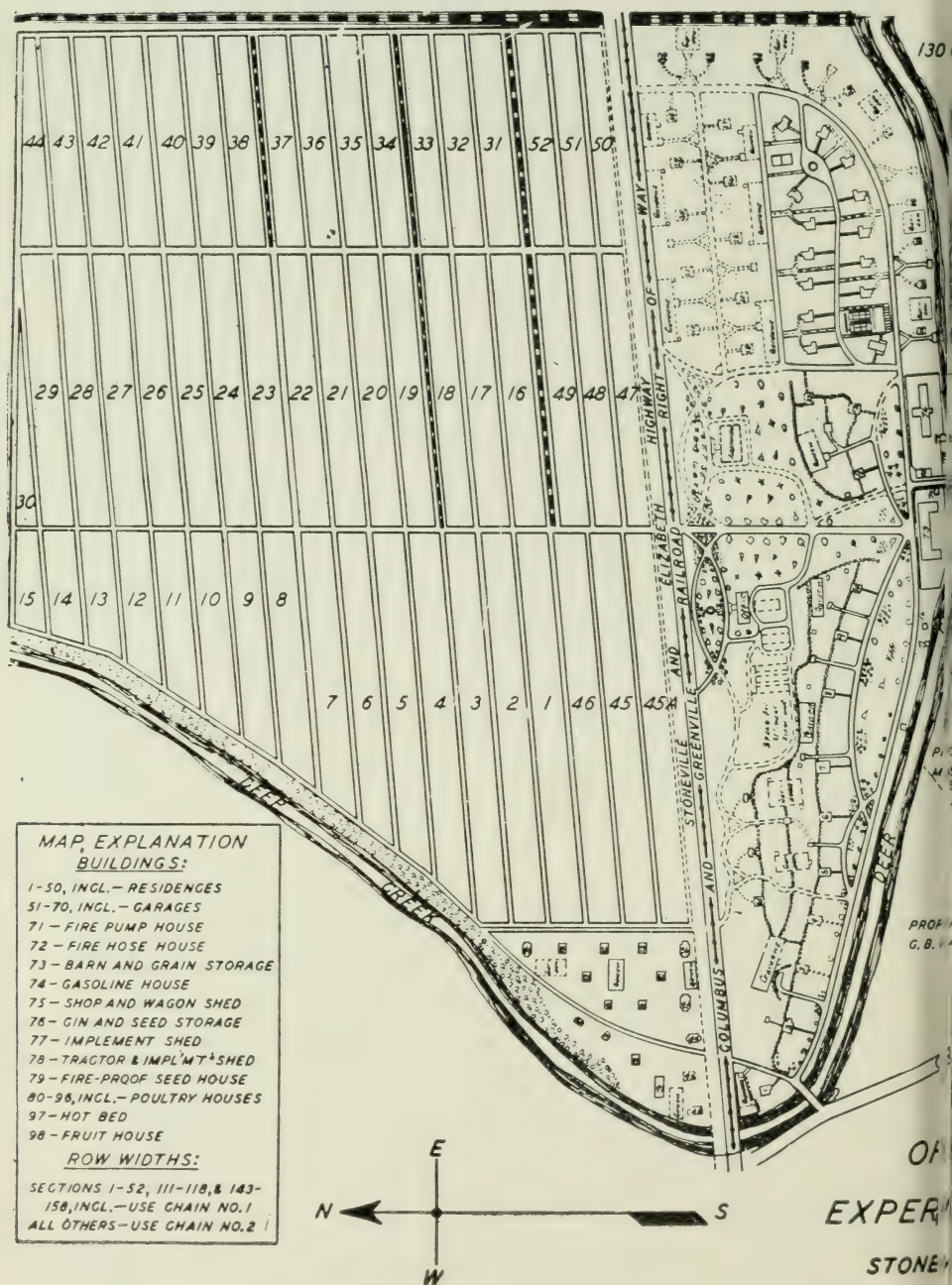
PUMPKINS: Sugar or Pie pumpkin is the only variety that should find a place in the garden. Seed-bed preparation, planting, and cultivation should be identical with that given for the cantaloupe in the garden. The average yield of this variety for two years has been 8,874 lbs. per acre.

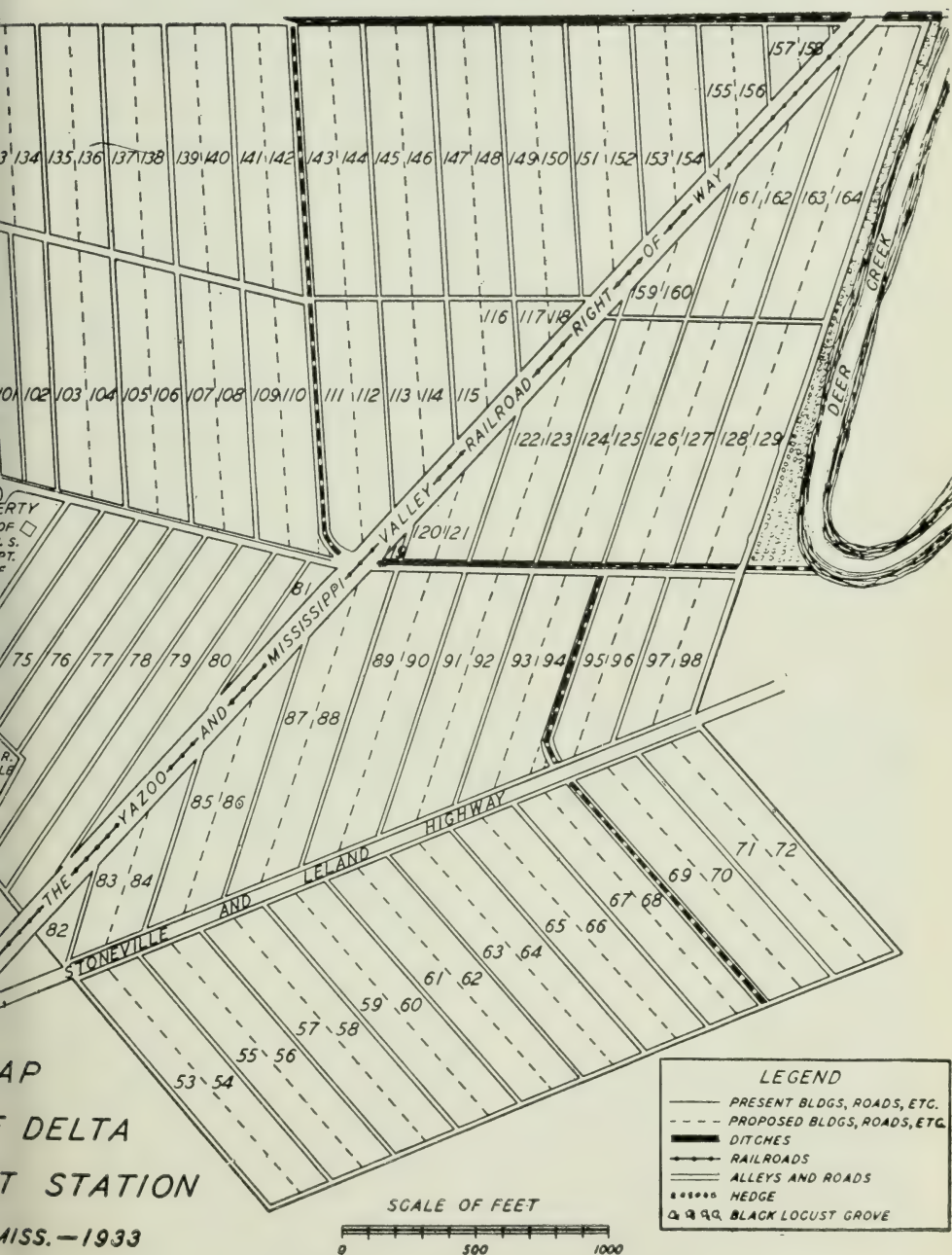
RADISHES: Radishes are among the most common garden crops. They grow very rapidly. Unless soil and weather conditions are favorable for rapid growth the quality is poor. Some of the earlier varieties mature in three weeks after planting. Radishes are best suited to early spring and late autumn planting, as they cannot withstand hot weather. For a continuous supply, plantings should be made at intervals of three weeks from February 15 until May 15 and from September 1 until November 1. For spring planting Long White Vienna, White Icicle, and Improved Chartier have been the best varieties over a period of eight years. White China and China Rose have been the best for late fall or winter.

SPINACH: Because of its value in the diet, and the ease with which it is grown, spinach should have a place in every early spring and fall home garden. New Zealand, commonly referred to as a variety of spinach, is not hardy, but true spinach withstands heavy freezes without damage. Long Standing Bloomsdale and King of Denmark are both good fall varieties. Spinach should be planted and cultivated similar to beets.



Horticultural Laboratory, Fruit and Vegetable Sales Office.





TOMATOES: The ease with which the tomato can be grown, its high food value, and its numerous table uses, make it the most satisfactory vegetable grown. A few plants set in suitable soil (Buckshot is excellent for tomatoes) and well cultivated will produce enough fruit in season for a small family. At least two varieties should be grown—an extra early variety, such as Earliana, and a late wilt resistant variety, such as Marglobe.

Tomatoes for early planting may be started in a hotbed about the middle of February. When the seedlings have their fourth leaf, they should be transplanted to the cold frame or thinned in the hotbed to about 3 inches. It is essential to avoid overwatering the plants, and under-ventilating the hotbed or cold frame. The seedlings should be transplanted to the garden when 5 to 7 inches high and all danger of frost is past. If hotbed or cold frame plants become too tall, the top buds should be pinched off to produce more stocky plants. Plants should be set 3 ft. apart in 4 ft. rows. Each plant should be staked and tied at intervals of growth to keep it off the ground. To prevent weed and grass growth, frequent, shallow cultivations are necessary.

Station tests indicate that tomatoes do not need as much fertilizer as other vegetables. Unfertilized plots in 1934 and 1935 outyielded the heavy complete fertilizer plots by over 5,000 lbs. of fruit per acre, annually. These different fertilizer combinations, however, are being continued.

Over a period of eight years the average yields in pounds per acre of seven varieties were as follows: Marglobe, 25,710; Livingston Globe, 24,465; Earliana, 22,285; New Stone, 21,381; Gulf States Market, 20,735; Norton Wilt Resistant, 17,875; and Ponderosa, 14,815. In a five year average Louisiana Pink yielded 24,865 lbs. per acre, and Greater Baltimore yielded 13,764 lbs. In a 4-year average Break O'Day yielded 36,343 lbs. per acre; Pritchard, 18,275 lbs.; Bonny Best, 17,017 lbs.; and Oxheart, 7,056 lbs. Marglobe, Earliana, Livingston Globe, Break O'Day, and Louisiana Pink are the five leading varieties.



Tomatoes on hog wire trellis to keep fruit off the ground.

TURNIPS: Turnips should be grown on very rich soil either as a spring or a fall crop. The spring crop should be planted in 3 foot rows about February 15 to March 1st. After the plants appear they should be thinned to two inches. Thinning for greens should be continued until the plants are 4" to 6" apart. The roots will be ready for use before hot weather. The fall crop should be sown broadcast on a smooth, well pulverized seed bed. The greens and turnips may be used all winter and into the following spring. Purple Top White Globe is by far the most outstanding variety for turnips and greens. This variety averaged 27,454 lbs. per acre of turnips and greens over a period of 9 years. The other varieties averaged in lbs. per acre as follows: White Flat Dutch, 15,250; Shogoin or Japanese Foliage, 15,173; Seven Top, 14,924; Amber Globe, 13,986; White Globe, 13,735; Purple Top Strap Leaved, 12,917; White Egg, 12,273; Tendergreen (foliage only), 10,246; and Southern Prize, 6,474. For foliage only Tendergreen, Shogoin, and Seven Top are the best three varieties.

MISCELLANEOUS VEGETABLES: Brussel's Sprouts are especially desirable for late summer and fall planting. They are miniature cabbages growing closely on the stalk of the plant and forming a small head at each leaf joint. They are very hardy and live through most winters. **Broccoli** and **Cauliflower** are very closely related plants. The seed of both should be sown in very early spring in the same manner as spring cabbages. The plants should be transplanted to the open garden when 4 to 5 inches high and given an abundance of water in dry weather. The outer leaves should be tied up over the heads to blanch the "curd" white, firm and tender. **Endive** is a very fine salad plant. The seed should be planted in early spring, the plants thinned to 12 inches in the drill, and permitted to grow until early fall. Then they should be cut back almost to the bud and covered 16 inches deep with straw, leaves, or light manure. The plants will grow all winter in this mulch and blanch well. **Kale** can be planted either as a spring or fall vegetable. The leaves make good greens especially after the frost has fallen on them. This plant is very hardy and withstands any of the winters here. **Kohl-rabi** forms an edible, turnip-shaped bulb above ground and when cooked has a flavor similar to that of cabbage and turnips combined. It should be grown as broccoli, cauliflower, or cabbage. **Parsley** can be planted in either spring or fall. It makes a splendid growth in sandy loam soil.



China Rose radishes planted the first of September and pulled the last of November.

TABLE 1—Crops and Varieties Suggested for Delta Use

Crops	Varieties
Asparagus:	Mary Washington
Beans, Bush:	
Green Pod Snap	Tendergreen, Bountiful, Tennessee Green Pod
Wax Pod Snap	Pencil Pod Black Wax, Curries Rust Proof Wax
Bush Lima	Jackson Wonder, Henderson
Beans, Pole:	
Pole Lima	Florida Speckled, Carolina Pole Lima
Pole Snap Beans	McCaslan, Kentucky Wonder
Beets:	Early Wonder, Crosby's Egyptian, Detroit Dark Red
Brussel's Sprouts:	Long Island Improved
Broccoli:	Mammoth White, Italian Green Sprouting
Cabbage:	
Early	Copenhagen Market, All Head Early
Mid-Season	All Season, Succession
Late	Drumhead, Late Flat Dutch
Cantaloupe:	Rockyford, Early Hackensack
Cauliflower:	Early Snowball, Erfurt
Carrot:	Red Cored Chantenay, Danvers Half Long
Chinese Cabbage:	Pe-tsai, Wong Bok
Collards:	Georgia, Georgia Cabbage Collard
Corn, Sweet:	
Yellow	Golden Gem, Golden Cross Hybrid
White	Honey June, Country Gentleman
Corn, Dent:	Early Adams, Truckers Favorite
Cucumber:	
Slicing	Early Fortune, Davis Perfect, White Spine
Pickling	Chicago Pickling, Snow Pickling
Egg Plant:	Black Beauty, Florida High Bush
Endive:	French, Broad Leaved Batavian
Kale:	Dwarf Curled Scotch
Kohl-rabi:	Early Purple Vienna
Lettuce:	
Head	New York (Crisp head), Big Boston (butterhead)
Leaf	Grand Rapids, Black Seeded Simpson, New York
Onion:	Bermuda, seed in fall; Prizetaker, Mountain Danvers, plants or sets in spring.
Parsley:	Moss Curled.
Peanut:	Virginia, Valencia
Peas:	Little Marvel, Thomas Laxton, Luscious Sugar
Pepper:	Chinese Giant, California Wonder, Ruby King
Potato:	
Irish	Irish Cobbler, Katahdin, Triumph
Sweet	Porto Rico, Nancy Hall
Pumpkin:	Sugar or Pie, Winter Luxury
Radish:	White Icicle, Improved Chartier, China Rose (for fall planting only.)
Spinach:	King of Denmark, Long Standing Bloomsdale
Squash:	Kitchenette Hubbard, Giant Summer Crookneck Delicious
Tomato:	Marglobe, Break O'Day, Livingston Globe
Turnip:	Purple Top White Globe, Shogoin, Seven Top
Watermelons:	Halbert Honey, Stone Mountain, Kleckley Sweet

TABLE 2—Planting Chart

Vegetable	Seed for 100-ft. of Row	Width of Rows	Spacing in Row	Seed or Plants Per A. (a)	Depth to Plant in Inches	Dates to Plant	Days to Maturity
Asparagus	1 oz. or 67*	60"	18"	5 lbs. or 5808 crowns	Crowns 8" Seed 1"	Oct.-Nov. Feb.-Mar.	2 to 3 yrs.
Bush Beans	1 lb.	24"-36"	3"-4"	60 lbs.	1 ½"-2"	Apr.-Sept.	45-60
Pole Beans	½ lb.	36"-40"	24"-36"	30 lbs.	1"-2"	Apr.-July	60-90
Beets	1 oz.	24"-36"	2"-4"	5 lbs.	1"-2"	Mar.-Sept.	50-70
Brussel's Sprouts	¼ oz.	36"	16"-24"	7260*	½"-1"	Jan.-July	90-120
Broccoli	¼ oz.	36"	16"-24"	7260*	½"-1"	Jan.-July	80-90
Cabbage	¼ oz.	36"	18"-24"	7260*	½"	Feb.-Sept.	80-120
Cantaloupe	½ oz.	6'	6'-7'	3 lbs.	1"-1 ½"	April	90-120
Cauliflower	¼ oz.	36"	18"-24"	7260*	½"	Feb.-July	100-130
Carrot	½ oz.	18"-36"	2"-3"	2 lbs.	½"	Mar.-July	60-80
Chinese Cabbage	¼ oz.	30"-36"	18"-24"	1 lb	½"	Mar.-July	80-120
Collards	¼ oz.	36"	14"-18"	9680*	½"	Feb.-July	100-120
Corn	¼ lb.	36"	12"-18"	15 lbs.	1"-2"	Mar.-July	70-80
Cucumber	½ oz.	48"-60"	48"	4 lbs.	½"-¾"	Apr.-July	60-80
Egg Plant	¼ oz.	36"	36"	1 oz. or 4840*	½"	April	80-100
Endive	½ oz.	24"-36"	8"-12"	16 oz.	½"	Mar.-Sept.	90-120
Kale	¼ Oz.	24" or B'cast	2"-4"	2 ½ lbs.	½"	Feb.-Oct.	40-80
Kohl-rabi	¼ oz.	36"	4"-8"	2 lbs. or 16,780*	½"-1"	Feb.-Sept.	60-80
Lettuce	½ oz.	36"	6"-8"	2 lbs.	½"-¾"	Feb.-Sept.	60-90
Onion	1 oz.	2'-3'	4"-6"	5 lbs.	½"	Sept.-Mar.	130-150
Parsley	¼ oz.	3'	3"-6"	1 ½ lbs.	⅝"-¼"	Apr.-Sept.	80-120
Peas	¾ lb.	3'	1"-2"	120 lbs.	1"-2"	Jan.-Feb.	50-80
Peppers	75-80*	3'	18"	9680*	⅝"	April	90-120
Potatoes, Irish	6 lbs.	3'	10"-16"	875 lbs.	2"-4"	Feb.-Aug.	80-120
Potatoes, Sweet	100*	3'	8"-12"	14,520*	4"	Apr.-June	130-200
Pumpkins	½ oz.	10'	6'-10'	1 ½ lbs.	1"-2"	Apr.-June	90-130
Radish	1 oz.	2'-3'	1"-2"	5 lbs.	½"-1"	Mar.-Sept.	30-50
Spinach	1 oz.	3'	1"-2"	10 lbs.	1"-1 ½"	Mar.-Sept.	40-70
Squash	½ oz.	6'	4'-5'	2 lbs.	1"-2"	Apr.-May July-Aug.	60-100
Tomato	30-40*	3'	4'	3630*	4"	Apr.-July	70-100
Turnip	½ oz.	3' or B'cast.	2"	3 lbs.	¼"-½"	Jan.-Sept.	30-90
Watermelon	1 oz.	8'-10'	3'-10'	1 ½ lbs.	1"-2"	Feb.-July	100-130

* Plants (a) Plants per acre are all figured from maximum distances in the drill.

INSECTS AND DISEASES

BEANS: **Bean Leaf Beetle** is the most serious pest of garden beans in the Delta. The reddish to yellowish, dark-spotted adult beetles feed on the underside of the leaves and eat round holes thru them. The slender white larvae chew the roots and feed on the stem just below the surface of the soil. The beetle passes the winter as an adult and hibernates in rubbish and trash. The adults are about one-sixth of an inch long with three black spots in a row along the inner edge of each wing cover and a black band all around near the outer margin of the wing covers. The females lay their eggs in the soil about the bases of the plants. One female may produce 500 eggs in 30 days. About 60 days are required for development from egg to adult. In the small garden, control may be obtained by spraying with any one of the pyrethrum extracts now sold at most drug stores. This spray should be applied to the underside of the leaves and repeated every ten days as long as the insects are present. Directions printed on the package should be followed closely. Magnesium Arsenate dusted very carefully on both the upper and lower surfaces of the leaves also controls the pest. One pound of Magnesium Arsenate should be thoroughly mixed with seven pounds of slacked lime before it is applied to the beans. Treatment should be repeated at intervals of 10 days until the beetles disappear. This Magnesium-Arsenate-Lime dust will also control the Striped Cucumber Beetle which attacks young bean plants and pods, as well as practically all other garden plants.

Anthracnose and Bacterial Blight are very serious bean diseases. Both diseases are carried in or on the seed. Anthracnose first appears as reddish brown spots on the seed leaves followed by similar spots on the veins of the true leaves. On the pods it appears as circular or irregular dark red to almost black spots with lighter centers. Bacterial blight appears first on the seed leaves as yellowish brown spots. On the leaves small water soaked areas are formed, which later dry out and break away. Both diseases are spread by rains and cultivation while the plants are wet. Control consists of pulling and burning all infected plants as soon as found. Both picking and cultivation must be avoided while the plants are wet to prevent spreading these diseases. Clean seed that show no discolored spots must be planted to avoid them.

BEETS: **Plant Lice** and other sucking insects can be controlled by applying 40% nicotine sulphate at the rate of one tablespoonful to the gallon of strong soapy water as a spray to both sides of the leaves.

Beet Leaf Spot appears first as circular reddish purple spots which soon become denser. Spraying the foliage with 4-4-50 bordeaux mixture when the spots first appear controls this disease. 4-4-50 means 4 pounds of rock lime, four pounds of copper sulphate, (bluestone) and 50 gallons of water.

CABBAGE: The **Cabbage Maggot** does its damage early in the season before the plants are very large. The standard treatment is to moisten the soil around the roots with a solution of bichloride of mercury (mercuric chloride or corrosive sublimate) which is very poisonous. The proper solution is made by dissolving one ounce of the poison powder or crystals in a quart of boiling water and then diluting to eight gallons with cold water. The solution should be kept in a wooden, stone, or glass vessel and applied out of an enamel-ware dipper. Aluminum and tin vessels must be avoided. Great care must be exercised while handling this poison.

Cabbage Worms appear as light green worms which literally eat up the plants. They can be controlled by regular weekly applications of a dust composed of one pound of lead arsenate and seven pounds of hydrated lime. This dust can be applied until the cabbage begin to head. A dust composed of one part of derris and four parts of cheap flour may then be used. Pyrethrum extracts may also be used satisfactorily after the heads begin to form.

Cabbage Lice may be controlled by spraying with one tablespoonful of 40% Nicotine sulphate mixed in a gallon of hot strong soapy water.

Black Rot is a bacterial cabbage disease carried on the seed. This disease appears on the young leaf as a V-shaped wilted area. Later the area enlarges and turns black or dark brown. With a severe infection the entire leaf turns yellow and falls. For control the seed should be soaked for 30 minutes in a solution made by dissolving one ounce of bichloride of mercury in 7½ gallons of water. After treating, the seed should be washed in fresh water and dried, since the solution is very poisonous.

Cabbage Yellows is a disease carried in the soil and on the young plants from the hotbed. Infected seedlings are yellow and wilt rapidly. In older plants the sickly yellow color persists and dwarfs the plants. The lower leaves drop off, then the ones higher up, until only a small undersized, diseased head remains. Control lies in growing disease resisting varieties, such as Hollander, Marion Market, All Head Select, and Wisconsin All Seasons.

Black Leg first appears on cabbage seedlings as small light brown cankers at the base of the stems. Similar spots may appear on the leaves and later within these spots very small black dots appear. Badly diseased plants often wilt and die. Blackleg may girdle the stem late in the season and cause the headed plant to fall over and die. Soaking the seed in hot water at 122° F. for 25 minutes and quickly cooling in fresh water is the only successful seed treatment. After this, the seed should be dried thoroughly.

SWEET CORN: Corn Earworm is the most destructive insect attacking corn when it is in the "milk" or "dough" stage. This insect tunnels into the ears thru the silks on which the eggs are laid. Dusting the silk just after it appears with equal parts of arsenate of lead and hydrated lime gives some protection. Two applications of this dust ten days apart should be enough. Tight-fitting-shuck varieties, such as the Honey June, are very resistant to the corn ear worm.

CUCUMBER: Cucumber Beetle is by far the worst enemy of Delta Cucumbers, squash, cantaloupes, and watermelons. It is a yellow, hard-shelled insect, with three black stripes down its back. It passes the winter in the adult stage. The beetles are among the first insects to start feeding on green plants in the spring. They sometimes burrow into the ground to meet the plants and eat them before they "come up." Entire stands are sometimes destroyed in one or two days. These insects also spread mosaic and wilt diseases. There are two or three generations of the beetles annually. The last generation feeds on the flowers and fruits of the above mentioned crops. The damage done by the twelve spotted cucumber beetle is about the same as that of the striped one. A well-mixed dust of one part of lead arsenate and 15 parts of gypsum or land-plaster will control these pests. Gypsum, as received from a builders' supply company, will have hair in it. This should be screened well before using. The first application should be made before the plants can be seen. Additional applications should be made at 3 or 4 day intervals until the plants are beyond the critical stage. Often 15 to 20 treatments are necessary.

Squash Bug is a dark gray or nearly black bug, about three-fourths of an inch in length, that sucks the sap from stems, vines, and fruit of cucumber, squash, pumpkin and melons. When one of these bugs is crushed it gives off a suffocating odor. There is no satisfactory spray or dust to control the hardened adults, hence they should be caught by hand when they first appear and dropped into a can of kerosene. A solution of 40% nicotine sulphate or a pyrethrum extract sprayed according to directions will kill the young before they hard shells form.

Bacterial Wilt is probably the most serious disease of the cucumber, cantaloupe and closely related plants. The leaves wilt very soon after the plant is infected. Wilt spreads rapidly to the stems and the entire plant very quickly withers and dies. It is spread by the striped and twelve spotted cucumber beetles and other insects. To control the disease the wilted plants should be pulled out as soon as they appear and the cucumber beetles eradicated as directed above.

Flea Beetle eats small holes in the leaves of the young plants of cucumbers, cantaloupes and watermelons but can be controlled by one or more applications of 4-4-50 bordeaux mixture.

Leaf Spot usually attacks the leaves and fruit in the later stages of development. It appears as brown or black spots which enlarge and cause infected parts to drop off. It can be controlled by weekly applications of 4-4-50 bordeaux.

LETTUCE: Lettuce-Drop and Bottom-Rot may become destructive if the soil moisture is kept too high. The rotting in these diseases usually begins on the stem or leaves near the soil surface and gradually spreads until the plant wilts and falls over. Sometimes the head stands and is converted into a slimy mass. Light cultivation to reduce soil moisture, and removing promptly the diseased plants will help hold these diseases in check.

MELONS—(Same as Cucumber.)

PEAS: Aphids or Green Plant Lice can be controlled the same as cabbage lice previously mentioned above.

Bacterial Blight produces water soaked spots on the leaves and pods which later turn yellow or brown. The plants gradually turn yellow and die. There is no direct control for this. Early planting in well-drained loam or sandy soil will help prevent serious damage.

POTATOES: Potato Beetle is a very familiar, almost round, large, striped, hard-shelled insect. The young slugs or very young beetles are red and soft bodied. They may be controlled either by dusting or spraying with calcium arsenate, arsenate of lead, or paris green. One part of calcium arsenate to ten of hydrated lime dusted on the plants while they are wet, gives quick control. One part of paris green to 20 parts of hydrated lime is also a very effective dust. If spray is preferred, 1 lb. of paris green or 2 of powdered arsenate of lead to 100 gallons of water is the proper mixture to use. These applications should be given at weekly intervals until all beetles are killed.

Fusarium Wilt can be practically eliminated when cutting the tubers to seed pieces, by cutting off from the stem-end a slice $\frac{1}{2}$ inch thick, and eliminating all potatoes showing a brown ring near the skin. The cutting knife should be disinfected frequently by dipping in a solution of lysol or other disinfectant. Only certified seed should be planted.



Variation in wilt resistance; left: Marglobe variety has no wilt; center: Early Detroit has much wilt; far right: Gulf States Market has very little wilt.

Early Blight and **Late Blight** often appear in early summer. Early Blight shows as brown or black spots on the leaves. Late Blight is seen as small watersoaked spots on the leaves which enlarge and cover the entire leaves with a moldy growth. Both may be controlled by thorough applications of 4-4-50 bordeaux mixture at intervals of 10 days.

For sweet potato diseases and their prevention see Farmers' Bulletin No. 1059, of the United States Department of Agriculture.

TOMATOES: The **Tomato Worm** is a large green worm, having a curved horn projecting backward at the tail, and is often found eating the leaves and fruit. Being a chewing insect, it may be controlled by the dusts or sprays suggested for the Potato Beetle.

Leaf Spot may appear at any time as small black or brown spots, which enlarge and cause the leaves to fall. Spraying with 4-4-50 bordeaux mixture at 10 day intervals will control this fungus.

Blossom-End Rot first appears as a small, sunken, water-soaked spot at the blossom end of the tomatoes. As this spot enlarges it turns dark and becomes leathery. It is caused by a lack of, or severe fluctuations in, the water supply of the plant at the time the fruit is forming. Clean cultivation and moisture conservation practices are suggested as control measures. Some varieties are more subject to this disease than others. The use of resistant varieties such as Marglobe and Pritchard may be necessary.

Wilt may be distinguished in the field by the yellowing of the lower leaves of the plant accompanied by wilting of the tops. The yellowing of the leaves progresses from the bottom of the plants to the top. Wilting is very rapid in susceptible varieties. When the stems of diseased plants are cut lengthwise, brown streaks can be seen to extend up the stems and into the leaves. Healthy plants do not show any discoloration of the cambium layer. The organism causing wilt lives in the soil on decaying organic matter. It causes the feeding roots to decay, and then grows up within the stems and leaves causing the death of the entire plant. The only practical control is the growing of resistant varieties such as Marglobe, Break O'Day, and Pritchard. Spraying has proved of no benefit, and long rotations have given only partial control.

GENERAL SUGGESTIONS

To control chewing insects a stomach poison such as arsenate of lead, calcium arsenate, or paris green should be used.

To control sucking insects such as plant lice, etc., a contact spray such as 40% nicotine sulphate at the rate of one tablespoonful per gallon of strong soapy water should be used. This is a contact spray and must touch the insect doing the damage.

For fungus diseases bordeaux mixture composed of 4 lbs. of rock lime (or 8 lbs. of hydrated lime), 4 lbs. of copper sulphate (bluestone) and 50 gallons of water should be used.

For an all-round spray a 4-4-50 bordeaux mixture, to which 1 lb. of arsenate of lead and $\frac{1}{2}$ pint of 40% nicotine sulphate for each 50 gallons of spray, should be used.

CUTWORMS: These insects attack corn, tomatoes, peppers, beans, peas, cucumbers, watermelons, cantaloupes, potatoes and other vegetables. Poison bran bait gives best control. The bait is prepared by mixing thoroughly 5 pounds of wheat bran, 4 ounces of white arsenic, 1 pint of molasses, 1 lemon with skin finely chopped, and enough water to moisten well. This bait should be scattered in the garden late in the afternoon. Two or three treatments in as many nights should be effective.

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H I N D S

A Compilation of
Experimental and Other
Data on

CORN PLANTING AND CULTIVATION

Compiled by
C. F. Clark
Coordinator Research Information

Jointly Representing
Mississippi Agricultural Experiment Station
and
Mississippi State Vocational Board

J. R. Ricks, Director
MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
State College, Mississippi

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The following quotation from a letter may help in understanding Table 26, Page 18:

"Of the six plots in a series, two were treated the same as given for plot 4. Since the yields of corn for the two plots, where "ordinary" cultivation without fertilization was practiced, were so variable, it was deemed advisable to report the individual plot yields rather than an average of the duplicates.

"The records do not indicate just what constitute "ordinary" cultivation in this particular experiment; neither do they offer any explanation as to the cause of the crop failures in 1913 and in 1914."

Very truly yours,

May 26, 1936.

D. C. Wimer, Assistant Professor,
Soil Physics, Agricultural Experiment Station,
University of Illinois,
Urbana, Illinois.

A COMPILATION OF EXPERIMENTAL DATA ON CORN PLANTING AND CULTIVATION

A. CORN PLANTING

Compare the production of the various varieties of corn when planted early and when planted late. What percentage of the yield is lost by planting at one time rather than at another?

How long after turning a winter legume should one wait before planting corn in order to prevent injury from budworms?

How should the seed bed be prepared for corn?

I

TIME OF PLANTING CORN IN MISSISSIPPI

TABLE 1—A COMPARISON OF EARLY AND LATE PLANTING OF CORN ON
BOTTOM LAND AT STATE COLLEGE, MISSISSIPPI, 1929-34

EARLY TEST		Yield in Bushels Per Acre					5 Year Average
Planted early part of April		1929	1930	1932	1933	1934	
College 47	.....	59	48	70	49	59	57
Coke's Prolific Sta.	.....	61	47	70	45	57	56
College G4	.....	57	51	70	41	60	56
Paymaster	.....	63	51	64	40	58	55
College Y4	.....	59	49	65	40	60	55
Hastings Prolific	.....	60	31	68	51	61	54
Mosby, Station	.....	57	41	69	45	56	54
Mosby, Delta	.....	57	35	69	44	57	52
Laguna	.....	53	41	63	44	56	51
Yellow Dent	.....	41	42	52	39	54	46
Golden Dent	.....	43	41	51	39	49	45
LATE TEST							5 Year Average
Planted June 1 to 15		1930	1931	1932	1933	1934	
Laguna	.....	32	54	36	38	50	42
College 47	.....	30	57	40	23	50	40
Coke's Prolific Sta.	.....	23	51	28	24	45	34
College G4	.....	26	57	29	13	46	34
Paymaster	.....	19	55	27	24	44	34
Hastings	.....	26	51	22	20	46	33
Mosby, Delta	.....	23	47	27	25	42	33
Mosby, Station	.....	23	47	27	23	42	32
College Y4	.....	21	53	28	13	44	32
Golden Dent	.....	15	42	20	21	53	26
Yellow Dent	.....	15	30	15	15	35	22

This experiment was run under the following conditions:

FERTILIZER: 20 to 30 pounds of nitrogen per acre, equivalent to 133 to 200 pounds of nitrate of soda or from 100 to 150 pounds sulphate of ammonia. It was usually applied in the form of sulphate of ammonia, when the plants were about 10 inches high. The sulphate of ammonia was applied by hand by each hill of corn.

SOIL TYPE: Bottom land. Ochlockonee fine sandy loam.

SIZE OF PLOTS: 1/20 acre repeated six times.

WIDTH OF ROWS: 3½ feet with two plants per hill spaced 3½ feet apart in the drill.

CULTIVATION: Enough cultivation was given to keep down weeds until corn was nearly mature.

The experiment has been run continuously on the same land.

LAND HISTORY: Before the beginning of this experiment the average yield of seed cotton per acre, with 500 lbs. of 6-8-4 fertilizer, was 1200 pounds.

The land for the late planting was usually prepared at least a month before

planting date. Even then, considerable difficulty was experienced in getting a stand due to dry weather. The rate of seeding on the late test was considerably heavier than that for the early test. Production in the late test was much better in 1934 than usual because of unusual rainfall.

SEED SOURCES: The seed of varieties used in this test were obtained from the following sources: Cocke's Prolific, Laguna, and Mosby Station from Mississippi Experiment Station, State College, Mississippi; Golden Dent from Russell Heckle, Memphis, Tennessee; Hastings Prolific from H. G. Hastings Co., Atlanta, Georgia; Mosby Delta, from the Delta Branch Experiment Station, Stoneville, Mississippi; Paymaster from W. H. Neal, Lebanon, Tennessee and Yellow Dent from Ferguson Seed Farms, Howe, Texas.

The other varieties tried like College 47, College G4, and College Y4 are first generation crosses and are not for sale by any seed house.

Reference: Mississippi Agricultural Experiment Station Information Sheet 57, State College, Mississippi.

II

PLANTING DATES OF CORN AT STATE COLLEGE, MISS.

The results which follow should help each corn grower to determine the date on which he can most profitably plant corn, other things considered.

TABLE 2—PLANTING DATE OF CORN

Spacing in Drill	Yield in Bushels Per Acre		June Planting		Average
	1913	1914	1913	1914	
4 feet.....	45	29	24	26	25
3 feet.....	57	30	30	28	29
2 feet.....	58	34	29	23	23
1 foot.....	61	35	24	30	27

In all the above plots the rows are 4 feet apart. On account of the exceptionally dry July in 1914, the early plantings were materially injured.

Reference: Mississippi Agricultural Experiment Station Bulletin 170, page 9, tables 8 and 9, January 1915, "Corn," State College, Mississippi.

	March		April		Date Planted (a)		June		July	
	1935	1934	1935	1934	May 1935	1934	1935	1934	1935	1934
Mosby	43.5	55.6	46.1	37.9	33.0	34.6	31.8	11.9	1.6	
Laguna	48.8	46.8	46.1	39.0	33.9	36.8	37.8	25.7	5.2	

(a) Planted approximately 15th of each month.

These results were obtained without the use of fertilizer. The soil was a fertile Ocklocknee loam. The three-row plots were 1/40 acre in size and data were collected from the middle row of each plot. There were six replications.

Reference: Mississippi Agricultural Experiment Station Information Sheet 97,

"Planting Dates of Corn," December 1935, State College, Mississippi.

III

TIME TO PLANT CORN TO PREVENT BUDWORM INJURY IN ALABAMA

The budworm (Southern corn root worm) is not distinctly an insect pest of vetch or Austrian Winter peas, but often does considerable damage to corn following these legumes. Table 3 shows the results of a six year experiment to determine the best time to turn winter legumes to avoid injury from bud worm at Auburn, Alabama.

TABLE 3—SIX YEAR AVERAGE PER CENT OF CORN PLANTS INFESTED
WITH THE BUD WORM, 1927-1932

Date of Turning Land*	Date of Planting Corn	Average per cent of Corn Infested following:	
		Legumes	No Legumes
March 15	March 16	45.7	8.7
March 15	March 23	55.5	7.9
March 15	March 30	39.2	12.2
March 15	April 6	30.0	7.5
March 15	April 13	12.3	6.6
April 1	April 2	49.2	8.3
April 1	April 9	29.6	8.6
April 1	April 16	28.6**	4.3**
April 1	April 23	9.6	4.9
April 1	April 30	3.2	2.0
April 15	April 16	24.7	2.9
April 15	April 23	8.6	2.3
April 15	April 30	2.1	2.0
April 15	May 7	0.6	0.8
April 15	May 14	0.1	0.0

*Approximate date

**Five-year average: 1933 not included due to mouse injury.

Reference: Circular 65, Alabama, page 8, Auburn, Alabama.

Reference: Mississippi Agricultural Experiment Station Bulletin 303, page 16, table 16, August 1934, "A Compilation of Experimental and Other Data on Winter Legumes", State College, Mississippi.

IV

DATES OF PLANTING CORN IN ARKANSAS, 1935

At the Cotton Branch Station, Marianna, Arkansas, three varieties were planted on the first and fifteenth of each month, April to July, inclusive. Thatcher's Golden Dent did poorly in this test, but the best yield (12.9 bushels) was from April 1 planting. Paymaster yielded 35.2 bushels when planted June 1 and 28.8 bushels when planted July 1. The lowest yield was 12.0 bushels from July 15 planting. Mexican June, though reputed a good variety for late planting made its best yields of 38.1 bushels from April 1 and 31.7 bushels from April 15 plantings. Its low yields were 9 and 10.8 bushels from the July plantings.

Reference: Arkansas Agricultural Experiment Station Bulletin 323, page 13, December, 1935, "Forty-Seventh Annual Report", Fayetteville, Arkansas.

V

DATES OF PLANTING CORN AT THREE STATIONS IN ARKANSAS

In corn production factors of soil outweigh differences in variety, and rainfall is a more important factor than soil type. Corn fails on the best soils in case of drouth at the time the corn is silking and developing the grain. The date of planting is therefore an important factor affecting yield.

Tests to determine desirable date of planting have included Funk's Ninety-day, Ferguson's Yellow Dent, Champion White Pearl, Hasting's Prolific, and Paymaster. In recent years Thatcher's Golden Dent replaced Champion White Pearl and in early years several other varieties were used in tests of 1 to 5 years.

TABLE 4—DATES OF PLANTING CORN AT THREE STATIONS IN ARKANSAS

	Main Experiment Sta. Fayetteville	Cotton Branch Sta. Marianna	Scott Experimental Field Scott
Total No. of Experiments	95	25	50
Planting Dates	No. of Cases in Which Highest Yields Were Made		
April 1.....	15	3	5
April 15.....	26	5	1
May 1.....	20	5	4
May 15.....	10	7	7
June 1.....	10	3	12
June 15.....	10	2	9
July 1.....	4	0	3
July 15.....	0	0	0

The accompanying table shows that in northwestern Arkansas 61 out of 95 tests favor April 1 to May 1 planting, with 26 recorded for April 15. At the Cotton Experiment Station late May planting seems to be best, and at Scott the best planting period extends from May 15 to June 1, with the greatest number of tests showing high yields from June 1 plantings.

Distributions made in like manner for each variety named above, show no varietal difference. Even Mexican June, reputed to be a good variety for late planting, at the Main Station showed the greater number of high yields to be from April 15 plantings.

Reference: Arkansas Agricultural Experiment Station Bulletin 297, page 43, "Summary of Research, Forty-Fifth Annual Report", April 1934, Fayetteville, Arkansas.

VI

The experiment Station at Baton Rouge is carrying on a number of experiments in an effort to determine how corn yields may be increased economically. In tests the past season it seemed that between March 10 and May 20 it did not make much difference when corn is planted. After June 1 there is a rapid decrease in yields. The yields for the different planting dates in 1933 were as follows:

March 10.....	47.8 bushels per acre
March 20.....	47.6 bushels per acre
April 5.....	53.6 bushels per acre
April 20.....	45.9 bushels per acre
May 5.....	43.9 bushels per acre
May 20.....	46.7 bushels per acre
June 5.....	34.9 bushels per acre
June 20.....	27.4 bushels per acre
July 5.....	16.6 bushels per acre

Results from different planting dates will no doubt vary somewhat depending on the season.

Reference: Louisiana Agricultural Experiment Station Circular 8, page 1, March 1934, "Corn Culture", Baton Rouge, Louisiana.

VII

MANNER OF PLANTING CORN IN NEBRASKA—11 YEARS

In farm practice, surface-planted corn may be either checked or drilled, whereas corn planted in furrows is almost always drilled. The spacing between hills of checked corn is usually 43 inches, with two or more plants per hill. Comparable rates are secured in drilled corn by the proper spacing of single plants within the rows. The wide spacing of rows by leaving the alternate rows uncropped is practiced to a very limited extent in the west.

TABLE 5—THE RELATION OF MANNER OF PLANTING TO THE YIELD OF CORN—1922-1932

Manner of Planting	Yield of Shelled Corn Per Acre*											
	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	Avg.
	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.
Surface-planted												
Check	45.0	50.3	28.0	40.3	0.0	59.4	23.6	48.6	10.5	19.9	48.6	34.0
Drilled	43.0	48.5	26.6	42.5	0.0	61.3	25.5	52.0	16.9	16.6	51.0	34.9
Alternate Rows, one half normal rate per A.	37.6	37.8	18.9	36.0	0.5	40.5	-----	-----	-----	-----	-----	-----
Alternate Rows, normal rate per A.	44.0	44.1	20.6	35.9	0.0	47.7	-----	-----	-----	-----	-----	-----
Furrow-planted**												
Furrow openers.....	40.4	44.0	24.4	32.7	1.3	60.7	23.9	44.9	10.0	18.9	51.0	32.0
Listed	40.1	32.4	28.4	42.3	7.1	61.1	33.1	44.1	16.2	13.0	63.7	34.7

*For the 11-year period the stover yields averaged as follows: surface planted 3426 lbs. and drilled 3429 lbs., listed 3088 lbs., and furrow openers 3263 lbs.

**Yields for furrow planting are transferred from Table 8 on a comparative basis. They bear the same relation in both tables to the checked corn on early spring plowing 7 inches deep. The yield for listing is calculated from the average of the three listing practices involving only spring treatments.

Reference: Nebraska Agricultural Experiment Station Bulletin 293, pages 8 and 9, table 2, January 1935, "Cultural Practices in Corn Production," Lincoln, Nebraska.

VIII

TABLE 6—EFFECT OF LEVEL AND RIDGED CULTURE ON CORN PRODUCTION ON LEVEL LAND AT BATON ROUGE, LOUISIANA

	On Bench Land at Baton Rouge Percent Increase Over Level						On Alluvial Land at Baton Rouge Percent Increase Over Level					
	1929	1930	1931	1932	1933	1934	1935	7 Yr. Av.	1933	1934	1935	3 Yr. Av.
Ridged culture....	4.4	22.1	15.3	4.8	3.5	2.5	19.5	10.3	1.1	24.4	19.5	15.0
Level culture.....	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Furrow planting						.9	2.4	-----		12.9	2.4	7.6

The land used was a fine loam that runs together rather badly during heavy rains and was of only moderate fertility. In all cases the corn was planted in rows four feet apart and a moderate application of a complete fertilizer applied before planting. In the ridged culture plats row beds were made as high as could be made with a two-horse turning plow and the cultivation was such as to maintain the bed. The other plats were planted on the level or very nearly on the level, and given level cultivation. The soil in the ridges appeared to be more porous and better aerated than the other.

Reference: Agricultural Experiment Station Mimeograph, "A Preliminary Report of Certain Variety, Fertilizer, and Other Tests Conducted by the Crops and Soil Department of The Louisiana Experiment Station—1935", Baton Rouge, Louisiana.

FLAT AND RIDGED CULTIVATION AT STATE COLLEGE, MISSISSIPPI

Kind of Cultivation	1911	Bushels Per Acre	Average
		1912	
Flat	39.8	44.5	42.1
Ridged	31.5	29.2	30.3

These plats were on a well drained soil. The corn was planted flat, and "laid by" as nearly flat as possible while the ridged plat was cultivated in the usual way for ridged crops except it was "laid by" with a Planet Junior cultivator in order to cover the peas.

Reference: Mississippi Agricultural Experiment Station Bulletin 170, page 8, table 6, January 1915, "Corn", State College, Mississippi.

IX

CORN SEEDBED PREPARATION IN TEXAS

Work was conducted in 1913 and 1914 to secure information as to the best method of preparing the seed bed. The results of this work are shown in the following table:

TABLE 7—SEEDBED PREPARATION EXPERIMENT

Method of Preparing Land	Yield Per Acre of Corn in Bushels			
	1912	1913	1914	Average
Plowed 8 inches.....	31.94	12.12	33.7	25.9
Plowed 6 inches.....	26.38	12.77	34.4	24.5
Plowed 4 inches.....	19.58	12.77	33.9	22.1
Listed 8 inches.....	29.72	13.33	31.8	24.9
Plowed 12 inches.....	11.66	15.00	29.6	18.7
Not Plowed	26.38	10.27	24.7	20.4

Beeville is on a latitude about 110 miles south of Biloxi and Gulfport, Mississippi. The annual rainfall for the five years 1910-14 averaged 31.95 inches. A part of the substation farm is on Victoria loam, with small amounts of Victoria sandy loam being present.

Reference: Texas Agricultural Experiment Station Bulletin 214, page 18, table 18, April 1917, "Progress Report, Substation No. 1, Beeville, Texas", College Station, Texas.

X

SEEDBED PREPARATION FOR CORN IN NEBRASKA

All comparisons were in multiple-row plats and the outside rows were discarded because of possible border effects. The plat areas generally ranged 1/40 to 1/10 acre in size. All tests except those pertaining to seedbed preparation were replicated one or more times. The standard spacing of 3.5 feet between rows and hills was maintained for all checked corn.

The grain yields are on the basis of air-dry shelled corn per acre. Field-cured stover yields were also determined for the seedbed and intertillage experiments.

During the 11-year period, 1922-32, 13 different methods of seedbed preparation were under comparison on the Experiment Station Farm. In seven of these practices the corn was surface-planted in hills on land that was plowed either in the fall, early spring, or late spring, as specified. In the other six practices, the seed was drilled in open furrows. These were made either by furrow-opener attachments or the corn planted on early-spring plowing, or by listing on land that had had either partial preparation in the fall or early spring, or else no previous preparation.

A three-year rotation of corn, oats, and winter wheat was followed. In the years intervening between the corn crops the tillage and cropping practices were alike on all plats. The seedbed was prepared for the oats in this rotation by double-disking the corn stubble, and for the winter wheat by plowing the oats stubble 5½ inches deep in July, with subsequent disking and harrowing. In preparation for the planting of corn, the treatments under comparison were as indicated in Table 8. As an average for the period, all fall treatments were completed on October 6 and the early-and late-spring treatments on March 29 and May 5, respectively. The corn was grown at the rate of three plants per hill, or its equivalent in the case of drilling. The average planting date was May 8.

TABLE 8—THE RELATION OF THE MANNER OF SEEDBED PREPARATION TO THE YIELD AND GROWTH OF CORN, 1922-32*

Manner of Seedbed Preparation 2*	Yield of Shelled Corn Per Acre											
	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	Avg.
	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.
Surface-planted (Checked)												
Early spring plowing:												
4 inches.....	32.0	53.6	29.3	28.9	1.0	43.7	37.5	50.9	2.4	17.5	39.2	30.5
5 1/2 inches.....	32.3	54.4	29.8	32.2	1.3	46.5	39.0	49.1	2.3	17.5	41.9	31.5
7 inches.....	39.0	61.8	32.6	33.8	1.1	47.4	34.9	49.7	2.7	21.2	42.0	33.3
10 inches.....	40.8	62.4	31.0	33.5	0.7	49.9	34.5	51.0	2.8	22.5	39.1	33.5
Late Spring plowing:												
7 inches.....	30.7	54.0	29.8	28.6	1.9	44.6	41.8	52.6	4.5	19.9	41.0	31.8
7 inches preceded by disking.....	40.5	61.1	32.9	24.4	0.9	45.2	37.1	53.9	2.9	21.3	40.7	32.8
Fall plowing:												
7 inches.....	32.2	49.9	27.9	19.1	8.5	50.0	28.9	33.7	0.6	13.5	37.2	27.4
Furrows opened 3* (Drilled)												
7 inch spring plowing (early).....	34.4	55.5	29.0	26.2	2.4	48.7	35.2	46.0	2.2	20.2	44.4	31.3
Listed (Drilled)												
Double listing:												
Fall and spring.....	36.2	50.4	30.4	31.6	4.6	49.4	39.3	42.9	2.9	13.1	54.8	32.3
Spring.....	37.8	43.9	31.9	37.6	7.0	49.9	44.6	46.0	6.7	11.0	58.8	34.1
Single listing:												
7 inch fall plowing.....	32.2	51.3	30.8	27.9	6.3	51.1	31.1	45.5	1.1	12.7	50.8	31.0
Double-disked ground.....	33.5	42.7	33.3	34.9	10.2	49.6	45.3	46.0	6.7	14.1	56.5	33.9
Hard ground.....	31.0	45.1	33.9	34.8	7.4	47.7	43.3	43.6	11.7	17.8	55.9	33.8

*The plats were 1/10 acre in area.

2*All spring-plowed land was harrowed after plowing, and the disk and harrow immediately preceded all surface planting as a measure of weed control.

3*Furrows made with a standard furrow opener attachment to an ordinary surface corn planter.

PREPARATION FOR FURROW PLANTING. Two devices were used for opening furrows: a furrow-opener attachment for the corn planter and a lister. The furrow openers were used on land plowed 7 inches deep in early spring. There were five different types of disking: (1) double listing in which the first listing was done in the fall and the ridges were listed out in late spring at the time of planting; (2) double listing in which the first was done in early spring, followed by splitting the ridges at the time of planting; (3) single late-spring listing on 7-inch fall plowing; (4) single late-spring listing on early-spring double-disked ground; and (5) single late-spring listing on ground that received no other preparation than the listing.

Reference: Nebraska Agricultural Experiment Station Bulletin 293, pages 5, 6, 7, and 8, table 1, January 1935, "Cultural Practices in Corn Production", Lincoln, Nebraska.

SUBSOILING FOR CORN AT STATE COLLEGE, MISSISSIPPI

Plat	1913	Bushels Per Acre		Avg.
		1914		
Not subsoiled.....	31.8	30		30.9
Subsoiled with plow.....	25.5	27.2		26.3
Subsoiled with dynamite.....	27.7	29.1		28.4

These plats were on a Houston clay soil of medium fertility. The subsoiling was done in March of 1913. The check plats were broken about seven inches deep.

Reference: Mississippi Agricultural Experiment Station Bulletin 170, page 7, table 4, January 1915, "Corn", State College, Mississippi.

B. CORN CULTIVATION

How often should corn be cultivated? How many cultivations should it be given? Is there a danger of cultivating too often?

How deep should corn be cultivated? When should it be laid by?

What is the purpose of cultivating corn? After studying these experiments can you set up some general principles in regard to cultivating corn?

I

VARYING NUMBERS AND DEPTH OF CULTIVATION AT STATE COLLEGE, MISSISSIPPI

The tables which follow present data collected from two corn cultivation tests. These tests were planted during the last half of April each year on a sandy loam soil. No fertilizer was used in any case. The plots were six rows in width and 1/20 acre in size, with four replications in each test. Each plot occupied approximately the same area each of the three years. The rows were three and one-half feet apart and the plants were spaced about three feet apart with two plants to the hill.

TABLE 9—VARYING NUMBERS OF CULTIVATIONS

Number of Cultivations	Total Bushels Per Acre			Average Percentage	
	1921	1922	1923	Avg.	Nubbins
None	15.8	0.4	0.0	5.4	70.0
Two	34.9	28.8	20.0	27.9	14.2
Four	35.8	38.3	36.3	36.8	10.2
Six	38.6	39.8	35.7	38.0	10.0
Eight	39.6	37.7	36.6	38.0	9.5

The early cultivations in the above test were made with narrow shovel blades on a stock having three feet. The latter cultivations were made with sweeps. All plots were thinned and hoed when the plants were three to six inches high. No other hoeing was done and weed growth was excessive on plots receiving less than four cultivations.

TABLE 10—VARYING DEPTH OF CULTIVATION

Kind of Cultivation	Total Bushels Per Acre			Average Percentage	
	1921	1922	1923	Avg.	Nubbins
Scraping with hoe.....	35.6	44.8	49.5	43.3	10.9
Spring tooth cultivator.....	38.7	46.4	45.7	43.6	9.4
Ordinary Cultivation.....	40.8	46.8	53.0	46.9	8.6
Deep shovel cultivation.....	40.9	46.0	48.2	45.0	8.8

All plots were thinned and hoed when the plants were three to six inches high. Cultivating plows were not used on plots scraped with hoe. The use of the spring tooth cultivator required more cultivations and more hoeing than did ordinary and deep shovel cultivation. Ordinary cultivation consisted of the use of narrow cultivating blades early and sweeps later. Deep shovel cultivation consisted of the use of new 8" and 10" shovels run deep at each cultivation. All cultivations were stopped shortly before the appearance of silks.

Reference: Mississippi Agricultural Experiment Station Information Sheet 62, "Corn Cultivation", January 1935, State College, Mississippi.

II EFFECT OF DEEP CULTIVATION IN GEORGIA AND ALABAMA

Tests comparing deep and shallow cultivation have been made by the Georgia and Alabama Agricultural Experiment Stations. The results of these tests are summarized in Table 11.

TABLE 11—EFFECTS OF DEEP CULTIVATION ON YIELDS OF CORN

Place	Date	Deep Culture (Bushels)	Shallow Culture (Bushels)
Alabama	1894	15.30	17.07
Georgia	1890	26.1	28.5
	1891	25.1	26.1
	1892	30.53	30.24
Average		24.25	25.47

Ga. Exp. Buls. 10, 15 and 20; Ala. Canebrake Bul. 18

Reference: Agricultural Education, Vol. 10, No. 2, October 1933, Clemson Agricultural College, Clemson College, South Carolina.

III DEEP AND SHALLOW CULTIVATION AT STATE COLLEGE, MISSISSIPPI, 1890-1894

Comparisons of deep and shallow cultivation have been made during four years, and the results, with a single exception, have invariably been in favor of the more shallow work. In all of this work we have used alternate plots in the same fields, usually three plots for each plan of work, and all the plots each year were cultivated the same number of times and on the same days. In all cases the first cultivation was given to all the plots with a Thomas smoothing harrow just as the corn was coming up, and the second cultivation was also the same for both, and consisted in "barring off" with a one-horse moldboard plow, after which the plots were hoed and thinned to a stand. Where deep cultivation was followed, the after cultivation was done with a bull-tongue when the ground was hard, and with a double shovel or a sweep when it was more mellow, the object being to stir the soil at least four inches in depth. At each working after the barring off the soil was thrown towards the rows. Where shallow culture was followed all the cultivation after the first plowing was done with a five-toothed cultivator which seldom loosened more than two inches of the surface soil. No attempt was made to throw the soil toward the rows, and the whole surface was kept as smooth and level as possible.

A great amount of similar work has been done at other stations, and in nearly every case the results secured have been the same as here. We have examined the records of 116 such tests made at thirteen different stations and find that:

61 tests of deep cultivation gave an average yield of 69.4 bushels per acre, while

55 tests of shallow cultivation gave an average of 74.7 bushels,

a difference of 9.8 bushels per acre, or more than fifteen percent in favor of shallow cultivation. In only five cases out of the entire number did the deep culture show the better results.

Reference: Mississippi Agricultural Experiment Station Bulletin 33, pages 62 and 63, March 1895, "Corn", Agricultural College, Mississippi, (State College, Mississippi).

IV CULTIVATION EXPERIMENTS IN ARKANSAS—18 YEARS

In 1909 work was begun on corn cultivation and continued without change for five years. In this experiment the method used as the check was cultivation of medium depth, about three inches, continued until the corn tasseled. This depth of

cultivation was assumed to be a safe one and as near a standard method as could be chosen. Continuing the cultivation until the corn was tasseled was presumed to be late enough to prevent much weed growth after corn was laid by.

Very shallow cultivation was limited to the depth of one inch. The deep cultivation was held at about five to six inches. No cultivation but weeds scraped off with a hoe was made a part of the experiment for the purpose of better determining the part that weeds play in questions surrounding cultivation and crop production. Laying by at waist high (considered early) and cultivation continued very late (roasting ear stage) need no explanation of purpose. Cultivation at medium depth changed to shallow later in the season was intended to find a more effective method than the usual one. Cultivation delayed for eight and twelve weeks with fertilizer added after twelve weeks, as in case of plot 5, were practices included in the experiment to determine, for Arkansas conditions, the merits of the theory that checking the growth of the corn crop early and forcing growth thereafter leads to increased yields.

TABLE 12—METHODS OF CULTIVATION AND YIELD FOR YEARS
1909 TO 1913 INCLUSIVE

Plot No.	Method Treatment	Yield Bushels Per Acre					
		1909	1910	1911	1912	1913	Average
1 ck.	Medium depth cultivation until tasseled.....	33.5	31.5	44.2	43.3	21.2	34.74
2	No cultivation, weeds scraped off.....	31.5	21.5	44.8	40.7	10.2	29.74
3	Weeds scraped off 8 weeks—Medium cultivation until tasseled.....	27.2	25.9	40.4	40.2	23.2	31.38
4	Weeds scraped off 12 weeks—Medium cultivation until tasseled.....	28.5	26.3	40.0	43.1	10.7	29.72
5	Weeds scraped off 12 weeks—Fertilizer added and medium cultivation until tasseled.....	34.1	27.4	47.3	44.6	20.2	34.72
6 ck.	Medium depth cultivation until tasseled.....	33.5	31.5	44.2	43.3	21.2	34.74
7	Cultivation very deep until tasseled.....	28.3	30.2	35.7	32.0	20.8	29.40
8	Cultivation very shallow until tasseled.....	31.4	33.2	44.8	45.7	20.2	35.06
9	Medium cultivation until waist high— shallow until roasting ear stage.....	31.7	35.3	44.2	48.8	24.5	36.90
10	Shallow cultivation until roasting ear— Fertilizer added just before tasseling.....	30.2	40.3	40.7	40.3	25.3	35.36
11	Medium cultivation until waist high.....		26.1	38.8	53.1	23.5	35.37
12 ck.	Medium depth cultivation until tasseled.....	33.5	31.5	44.2	43.3	21.2	34.74

In 1914 the work was begun on another farm and the plan was somewhat changed. The method used as a check was much the same as that employed earlier, practically medium cultivation up to the stage of tasseling. The plan included very shallow cultivation and deep cultivation for the same period. It included different depths of cultivation up to certain stages, changing to shallow cultivation. It included varying numbers of cultivations from only two, for the season, up to ten different cultivations for the season. Delayed cultivation and other variations were included.

The work of 1915 is similar to that of 1914, but somewhat narrower in scope. The same method used as basis for comparison in 1914 was continued as the check.

The year 1916 was almost a total failure as a corn year, due to extremely severe drouth in the fruiting period. As compared with the checks for that year, deep cultivation, continued late, gave an increase of 3.6 bushels, and the highest yield obtained in that season. The next highest yields were obtained from deep cultivation. No cultivation brought no yields at all. While the results of the year were in favor of deep cultivation, the corn yields of that year were so low as to leave the results in doubt, excepting as they verify results of other seasons.

The work for 1917, was abbreviated and separated into two parts, namely, methods of cultivation, and stages of laying by. The method used as the check was the same. In this season weeds were allowed to remain in one case, resulting in practically total loss of the crop.

The work of the year 1918, was similar to that of 1917. The only practices resulting in a gain over check were those involving deep cultivation.

TABLE 13—YIELDS FROM DIFFERENT METHODS OF CULTIVATION, 1914-1916, FAYETTEVILLE, ARKANSAS

Method of Treatment		Yield in Bushels Per Acre				
Early	Late	1914	1915	1916	1917	1918
Very shallow until tasseled.....		39	.....	.....	.....	.....
Medium deep until 3 ½ ft. high.....	Shallow until tasseled.....	39	.....	.....	16	24
Deep until 3 ½ feet high.....	Shallow until tasseled.....	40	.....	3	14	.....
Very deep until tasseled.....		35	58	.....	.....	23
Cultivation delayed 4 weeks.....	Weeds scraped off.....	47	51	.....	.....	.....
Cultivation delayed 8 weeks.....	Weeds scraped off.....	17	46	.....	.....	.....
No cultivation.....	Weeds scraped off.....	15	57	1	17	13
Two cultivations only.....		26	.....	.....	.....	.....
Three cultivations.....		.....	54	2	.....	11
Four cultivations only.....		33	.....	.....	.....	.....
Very shallow until.....	Roasting ear stage.....	31	53	.....	.....	.....
Medium deep until 3 ½ ft. high.....	Shallow until roasting ear stage.....	32	64	.....	.....	.....
Deep until 3 ½ feet high.....	Shallow until roasting ear stage.....	33	51	.....	.....	.....
Very deep until.....	Roasting ear stage.....	33	56	4	.....	.....
Delay 4 weeks.....	Shallow until roasting ear stage.....	35	.....	.....	.....	.....
Delay 8 weeks.....	Shallow until roasting ear stage.....	15	.....	.....	.....	.....
Medium shallow.....	Until roasting ear stage.....	.....	64	1	15	17
Weeds allowed to remain.....		.....	.....	0	2	2
Deep until 3 ½ feet only.....		.....	.....	4	.....	.....
Medium shallow until 2 ft. high.....		.....	.....	.....	18	11
Average yield of * Check Plots..... Medium shallow until tasseled.....		34	60	1	15	19

*7 check plots in 1914, 4 each in 1915 and 1916, 2 in 1917 and 3 in 1918.

Work on methods of cultivation was expanded and continued the same during the two years of 1919 and 1920.

TABLE 14—METHODS OF CULTIVATION, YIELDS FOR YEARS 1919 AND 1920

Plot No.	Method of Treatment		Yield in Bushels Per Acre		
	Early	Late	Actual Yield	Actual Yield	Ave. for 1919 & 1920
1x Medium shallow until tasseled.....			1919	1920	1920
2 Shallow until tasseled.....	Laid by deep.....		49.2	34.0	41.5
3 Deep until tasseled.....			51.2	29.2	40.2
4x Medium shallow until tasseled.....			50.0	39.8	44.9
5 Medium deep until tasseled.....			55.7	44.8	50.3
6 Scraped with hoe.....	No cultivation.....		51.2	43.5	47.3
7x Medium shallow until tasseled.....			51.0	43.6	47.3
8 No cultivation.....	Weeds allowed to grow.....		46.5	30.8	38.7
9 Scraped until 2 feet high.....			5.1	2.0	3.6
10 No cultivation until 2 feet high.....	Deep cultivation.....		19.7	28.2	24.0
11x Medium shallow until tasseled.....			36.8	32.4	34.6
12 Shallow until 2 feet high.....	Scraped with hoe.....		49.2	36.2	42.7
13 Deep until 2 feet high.....	Scraped with hoe.....		49.3	32.3	40.8
14x Medium shallow until tasseled.....			52.6	28.4	40.5
15 Shallow until waist high.....	Laid by deep.....		54.0	31.1	42.6
16 Shallow until waist high.....	Scraped with hoe.....		54.4	41.9	48.2
17 Shallow until waist high.....	Weeds remain.....		53.5	40.6	47.1
18x Medium shallow until tasseled.....			38.3	33.9	36.3
19 Shallow until roasting ear.....			43.8	44.1	44.0
20 Shallow until roasting ear.....	Laid by deep.....		44.1	45.5	44.8
21x Medium shallow until tasseled.....			48.8	39.0	43.9
			52.7	35.1	43.9

The season of 1921 was favorable for corn. The average yield resulting from medium depth of cultivation in this experiment was about 56 bushels per acre.

The season of 1922 was likewise favorable for corn. The average yield from medium cultivation was about 52 bushels per acre.

The season of 1923 was less favorable for corn. The average yield from the medium depth of cultivation resulted in about 28 bushels per acre. Very shallow cultivation until tasseled, cultivation delayed 6 weeks, laying by very early, weeds scraped off with no tillage, all resulted in heavy loss.

TABLE 15—YIELDS OF CORN VARIOUS METHODS OF CULTIVATION,
1921-24, FAYETTEVILLE, ARKANSAS

Method of Treatment	Yield in Bushels Per Acre				
	1921	1922	1923	1924	Average
xMedium shallow until tasseled.....	53	55	33	46	47
Very shallow until tasseled.....	56	51	27	42	44
Medium deep until tasseled.....	60	55	33	49	49
xMedium shallow until tasseled.....	60	52	34	47	48
Deep until tasseled.....	61	47	28	45	45
Scraped with hoe.....	53	51	18	43	41
xMedium shallow until tasseled.....	54	49	20	44	42
No treatment.....	6	1	....	....	....
Medium shallow until 2 feet high.....	50	53	19	37	40
xMedium shallow until tasseled.....	63	60	27	41	48
Medium shallow until waist high.....	51	55	32	42	45
Medium shallow until roasting ear.....	53	57	32	42	46
xMedium shallow until tasseled.....	57	54	27	44	45
Cultivation 4 weeks after planting.....	54	52	27	43	44
Cultivation 6 weeks after planting.....	40	53	21	37	38
xMedium shallow until tasseled.....	53	50	25	40	42
Cultivation 8 weeks after planting.....	23	38	21	34	29
Laid by deep waist high.....	53	53	24	45	44
xMedium shallow until tasseled.....	58	47	16	50	43
Laid by deep when tasseled.....	55	42	28	48	43
Laid by deep in roasting ear.....	50	44	25	48	42
xMedium shallow until tasseled.....	46	49	30	45	42

xCheck plot

CORN CULTIVATION WORK AT SCOTT, ARKANSAS

Beginning with 1921 the experiment was begun at Scott and carried on in a similar manner to the work at Fayetteville. The season of 1921 was fairly favorable in that locality for the corn crop.

The yields for 1922 were exceedingly variable. The land apparently lacked much in uniformity as some of the checks yielded much lower than others.

In 1923 the yields of corn averaged low. The majority of methods of cultivation resulted in losses over checks.

The work in 1924 was enlarged and each method was run in triplicate. The season brought some good results, however, weather conditions were such as to emphasize soil differences resulting in much variation in yields.

TABLE 16—YIELDS OF CORN FROM VARIOUS METHODS OF CULTIVATION
ON DELTA SOIL, SCOTT, ARKANSAS, 1921-24

Method of Treatment	Yield in Bushels Corn Per Acre			
	1921	1922	1923	1924*
Very shallow until tasseled.....	43	24	17	12
Medium deep until tasseled.....	43	26	16	15
Deep cultivation until tasseled.....	20	18	13	16
Scraped with hoe—not cultivated.....	15	15	10	16
Weeds allowed to remain—no cultivation.....	1	6	1	3
Medium shallow until 2 feet high.....	39	26	18	25
Medium shallow until waist high.....	29	35	20	32
Medium shallow until roasting ear stage.....	43	34	21	31
Cultivation begun 4 weeks after planting.....	...	24	19	28
Cultivation begun 6 weeks after planting.....	...	23	15	25
Cultivation began 8 weeks after planting.....	...	8	16	18
Laid by deep when waist high.....	...	46	27	28
Laid by deep when tasseled.....	33	52	33	22
Laid by deep when in roasting ear.....	27	44	30	17
Medium shallow until tasseled (Av. 8 plots).....	36	31	20	23

*Average of 3 series in 1924.

Reference: Arkansas Agricultural Experiment Station Bulletin 219, pages 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, and 20, tables 3, 10, 11, 16, and 21, June 1927, "Cultivation Experiments With Corn", Fayetteville, Arkansas.

V

CORN TILLAGE METHODS AT JACKSON, TENNESSEE, 3 YEARS

Experiments in methods of tillage of corn were conducted for three seasons. Each year four methods were compared, as follows:

- Method 1. No cultivation, but weeds scraped off with hoe.
- Method 2. Shallow cultivation, 12-tooth cultivator used throughout the season.
- Method 3. Deep cultivation, double-shovel used according to common custom.
- Method 4. First cultivation deep, with double-shovel, but after cultivation shallow.

TABLE 17—CORN, TILLAGE EXPERIMENTS—AVERAGE YIELDS
FROM THREE SEASON'S TRIAL, 1911-13

Experiment No.	Method of Cultivation	Yield of Grain Per Acre Bu.
1	No Cultivation, but weeds scraped off with hoe	37.7
2	Shallow cultivation, 12-tooth cultivator used throughout season	40.9
3	Deep cultivation, double-shovel used throughout season	38.9
4	First cultivation deep, but after cultivations shallow	42.7

The soils at the West Tennessee Experiment Station farm are silt loams such as are found over large areas in that part of the state.

Reference: Tennessee Agricultural Experiment Station Bulletin 109, pages 234 and 215, table IV, September 1914, "Fertility and Crop Experiments at the West Tennessee Station", Knoxville, Tennessee.

VI

EFFECT OF CULTIVATION ON YIELDS IN VARIOUS STATES

The United States Department of Agriculture started a series of cooperative tests in 1906 in an effort to determine how weeds affected yields of corn. Several paragraphs quoted from U. S. D. A. Bureau of Plant Industry Bulletin 257 give details of these experiments.

"The early tests of five agricultural experiment stations (first set of figures in Table 18) covering the relation of weeds to the tillage requirements of corn were all conducted as a part of a series of experiments on the depth of cultivation. All of them had plats of deep and shallow cultivation, and some had medium-tilled, 'standard'-tilled and mulched plats. The non-tilled plats were referred to as having been 'hoed' or 'scraped' in all the experiments except those in Utah, where they were 'scarified' with a scuffle hoe.

"In the work conducted by the Department of Agriculture, beginning in 1906, an outline was furnished each cooperator describing in detail how the test should be made. The salient points in the outline were as follows: A piece of land of very even productivity was to be selected; preparation for planting was to be made by thorough breaking and harrowing and the planting was to be done by drilling on level land—that is, without ridges.

"The size of the plats was left to the cooperator. In the work from 1906 to 1910 the plats consisted for the most part of five rows each, making with the one intermediate row which was discarded at harvest, 11 rows in the experiment. In the work of 1911 most of the experiments were conducted on four plats of five rows each, with three intermediate rows, one between every two plats, which were discarded at harvest. The length of the plats varied with the convenience of each man, the average length being about 250 feet.

"After planting, one plat or series of plats was to receive absolutely no cultivation, the weeds and grass being removed at frequent intervals by means of a sharp hoe. This hoe was to be used with a horizontal stroke to cut out the vegetation at the soil surface, and particular care was to be paid not to stir the soil any more than was absolutely necessary. The other plat or series of plats was to receive the

ordinary cultivation and in addition to have the weeds and grass removed by chopping so as to eliminate the weed factor."

Table 18 gives a summary of the results of 125 tests. The results from the uncultivated corn are expressed as a percentage of the yields from similar cultivated areas. Of the 125 tests one test showed fodder yields only, 70 showed grain yields only, and 54 showed both fodder and grain yields.

TABLE 18—EFFECTS OF CULTIVATION ON YIELDS OF CORN BY YEARS

Designation of Experiments	Fodder		Grain	
	Number of Experiments	Percentage Yield Uncultivated	Number of Experiments	Percentage Yield Uncultivated
Early experiment station work.....	2	85.35	12	98.5
1905 and 1906.....	3	96.36	5	108.4
1907	2	91.6	8	110.84
1908	4	94.95	6	97.93
1909	10	101.15	25	105.27
1910	19	96.19	43	96.51
1911	15	91.24	25	92.37
Total	55	.....	124	.....
General average .....	.....	95.1	.....	99.108

U. S. D. A. Bureau of Plant Industry Bul. 257

Table 19 shows the number of experiments run in each state and the relative grain yields.

TABLE 19—EFFECTS OF CULTIVATION ON YIELDS OF CORN BY STATES

State	Number of Experiments	Percentage Yield Uncultivated	State	Number of Experiments	Percentage Yield Uncultivated
Arkansas	1	77.4	Missouri	3	103.2
California	2	86.8	Nebraska	1	101.9
Colorado	1	90.1	New Hampshire	10	112.71
Connecticut	4	98.8	New York	4	104.7
Florida	1	87.1	North Carolina	2	92.15
Georgia	1	138.8	Ohio	10	96.17
Illinois	8	94.74	Oregon	2	99.3
Indiana	9	105.36	Rhode Island	1	89.6
Iowa	7	102.72	South Carolina	12	99.07
Kentucky	9	91.28	Tennessee	2	89.4
Louisiana	4	105.8	Texas	8	92.59
Maine	3	77.9	Virginia	9	88.51
Maryland	1	109.2	West Virginia	2	77.9
Michigan	7	116.26			
Minnesota	1	100	Total	125	

U. S. D. A. Bureau of Plant Industry Bul. 257

Reference: Agricultural Education, Volume 10, No. 2, October 1933, pages 23, 24, and 25, tables 11 and 12, Clemson College, South Carolina.

VIII

EFFECT OF CULTIVATION ON YIELDS IN VIRGINIA— 4 YEAR AVERAGE

Tests have been made by the Virginia Agricultural Experiment Station to determine the value of cultivation and the number of cultivations best for corn. The average results for the years 1913 to 1916, inclusive, are given in Table 20.

TABLE 20—EFFECTS OF CULTIVATION ON YIELDS OF CORN,
FOUR-YEAR AVERAGE

Treatment	Average Yield Per Acre	
	Grain (Bu.)	Fodder (Tons)
No cultivation, weeds allowed to grow.....	8.17	.71*
No cultivation, weeds cut with hoe.....	49.04	1.41
Cultivated three times.....	59.44	1.59
Cultivated five times.....	58.69	1.55

Va. Bul. 214

*Three-year average.

Reference: Agricultural Education, Volume 10, No. 2, October 1933, page 26, table 14, Clemson College, South Carolina.

WEED CONTROL VERSUS MOISTURE CULTIVATION IN ILLINOIS

Morrow and Hunt began some experiments in 1888 to determine the value of cultivation and its best depth and frequency; also the effect of root pruning. These experiments were continued up to and including 1893 by Gardner. Table 21 reprinted from Bulletin 181 of this Station, gives a partial summary of the results obtained in these early cultivation experiments, and Table 22 shows the rainfall by months during the time the experiments were in progress, with the exception of the year 1888, for which the record is not complete.

TABLE 21—RESULTS OF CULTIVATION OF CORN AND ROOT PRUNING AT URBANA, 1888-1893
(BUSHELS PER ACRE)

Plot No.	Kind of Cultivation	1888	1889	1890	1891	1892	1893	3 Yr. Av.	4 Yr. Av.	5 Yr. Av.	6 Yr. Av.	Av. % of No. 2
1	None, weeds kept down by scraping with hoe	90.0	77.1	69.1	55.3	76.8	28.7	78.7	72.9	73.6	66.2	96.9
2	Shallow, 4 or 5 times	93.8	84.6	64.8	58.4	70.1	36.3	81.7	75.9	70.3	68.3	100.0
3	Deep, 4 or 5 times	84.9	74.2	60.8	63.4	80.1	33.6	73.3	70.8	66.7	66.2	96.9
4	Shallow, 12 to 14 times	94.6	80.9	71.1	.....	81.5	35.9	82.2	.....	72.8	.....	103.6
5	Deep, 12 to 14 times	84.5	68.8	69.4	.....	74.2	30.6	74.2	.....	64.5	.....	91.7
6	Roots unpruned, shallow, ordinary	97.0	90.9	78.7	70.0	78.9	33.4	88.8	84.1	75.8	74.8	109.5
7	Roots pruned, shallow, ordinary	91.0	78.3	53.0	48.7	70.7	26.2	73.7	68.2	64.2	61.6	90.2
8	Roots unpruned, weeds scraped off with hoe	94.0	85.8	76.7	66.3	.....	.....	83.5	80.7	.....	.....	106.3
9	Roots pruned with knife, weeds scraped off with hoe	85.5	68.4	61.5	39.7	.....	.....	71.8	63.8	.....	.....	84.1

The above table is reprinted, except for six-year average and corresponding percentages, from Bulletin 181 of this Station. These results have been reported in detail and progressively in Bulletin 4, 8, 13, 20, 25, 31, and 37.

*Based on all comparable yields.

TABLE 22—RAINFALL AT UNIVERSITY OF ILLINOIS, 1889 TO 1893
(INCHES)

	January	February	March	April	May	June	July	August	September	October	November	December	Total
1889	1.48	2.08	1.61	.61	5.52	8.00	5.81	.60	2.74	1.42	4.28	1.82	35.97
1890	.....	1.87	2.70	4.11	3.56	3.80	2.83	1.93	1.19	2.35	1.63	.05	31.28
1891	.....	2.60	3.55	3.54	.....	2.08	1.41	2.86	.41	1.29	5.58	1.53	26.73
1892	.....	.79	2.64	6.45	7.86	5.36	2.50	2.43	.93	.....	4.95	1.62	39.05
1893	1.05	4.48	3.20	7.68	4.83	1.65	.59	.06	3.62	1.14	2.98	1.09	32.27
Average	1.91	2.73	2.73	4.48	4.53	4.16	2.63	1.58	1.78	1.43	3.88	1.22	33.06

The record for 1888 is incomplete; hence not reported.

LATER EXPERIMENT AT URBANA, ILLINOIS

The results obtained by Morrow and Hunt were contrary to popular belief and seemed so remarkable that in 1906 and 1907 a series of experiments were begun to test them and at the same time to obtain information on some other features such as the damage resulting from allowing weeds to grow and the value of seed-bed preparation, irrigation, fertilizer treatment.

The soil on which these experiments were conducted is Brown Silt Loam, an upland prairie soil formed from loess overlying the drift of the early Wisconsin graduation. This soil is fairly representative of the gently undulating areas of the corn belt in Illinois. The field had been under cultivation for fifty years or more, but during that time no fertilizer had been applied, with the possible exception of barnyard manure.

A four-year rotation of corn, corn, oats, and clover was practiced. The cornstalks and both crops of clover were removed. In 1912 and 1914 soybeans were grown because of the failure of clover. The cultivating was done with the three-shovel cultivator till 1912, and after that the surface cultivator was used.

While the total rainfall of 1911 and 1913 appears to be approximately normal, yet in both these years there were dry periods during the time when corn should have been making its growth and needed a large supply of moisture. It will be noted that in 1911 during July only .56 inch fell; in June, 1.67 inches; in July, 1.52; and in August 1.44 inches. The year 1913 was the driest during the growing time for corn since the rainfall record has been kept at the University.

It will be noted that plots 3N, 5 and 6 were irrigated.

TABLE 23—RESULTS OF TILLAGE EXPERIMENTS WITH CORN AT URBANA ON BROWN SILT LOAM*, 1907-1915
(BUSHELS PER ACRE AS AN AVERAGE OF TWO PLOTS)

Plot No.	Treatment	1907	1908	1909	1910	1911	1912	1913	1914	1915	9 Yr. Av. ('09-1911-15)	8 Yr. Av. out ('15)
1	Not plowed or cultivated, weeds kept down by scraping with hoe	38.2	25.0	28.6	33.1	25.5	46.2	16.4	38.5	64.9	35.2	36.0
2	Plowed, seed bed prepared, no cultivation, weeds kept down by scraping with hoe	44.0	33.0	50.7	40.6	39.8	75.5	33.9	49.9	72.9	48.9	48.7
3S	Plowed, seed bed prepared, weeds allowed to grow	0.0	16.0	10.7	.4	.7	7.4	10.3	12.3	8.6	7.4	7.0
3N	Plowed, seed bed prepared, weeds allowed to grow, irrigated					1.7	11.5	12.3	20.4	5.9	.....	10.4
4	Plowed, seed bed prepared, shallow cultivation 3 times	49.6	25.0	31.4	45.7	34.5	65.2	21.9	40.2	76.0	43.3	44.8
5	Plowed, seed bed prepared, shallow cultivation 3 times, irrigated	49.8	28.2	40.0	50.2	55.0	61.2	41.2	56.2	70.3	50.2	51.5
6	Plowed, seed bed prepared, shallow cultivation 3 times, irrigated, fertilized	102.2	28.8	42.9*	78.3	77.3	93.0	50.5	56.1	71.9	.....	69.8

The 1906 results, as given in Bulletin 181, are incomplete, and since the experiment for that year was conducted on a different plot of ground, it seems advisable to omit entirely the 1906 yields from this publication.

*This soil would probably be classified as Tama silt loam by the Bureau of Soils, U. S. Department of Agriculture.

*Yield of one plot only. Through a mistake fertilizer was not applied to the 2d-year corn plot in 1909.

TABLE 24—RAINFALL AT THE UNIVERSITY OF ILLINOIS, 1907-1915 (INCHES)

	January	February	March	April	May	June	July	August	September	October	November	December	Total
1907	6.12	2.4	3.34	2.34	4.96	5.56	5.01	4.42	.94	1.51	1.99	3.32	39.75
1908	1.11	3.79	3.20	5.00	7.83	1.99	2.31	2.05	1.95	.21	1.99	1.44	32.87
1909	2.17	5.80	1.76	7.44	5.56	3.75	7.57	2.37	2.36	2.25	3.45	2.55	47.03
1910	2.23	1.79	1.38	1.57	5.36	2.99	2.76	2.62	4.14	1.34	1.20	1.59	27.96
1911	2.27	1.19	1.85	3.59	2.44	1.82	.62	3.35	8.90	3.10	2.83	1.35	32.31
1912	1.36	2.28	3.42	5.60	4.16	1.89	3.68	2.06	1.76	2.95	1.77	.77	31.50
1913	5.38	1.10	5.99	2.19	.56	1.67	1.52	1.44	2.50	4.03	4.49	.77	31.64
1914	1.97	2.50	.89	2.87	1.94	2.40	1.44	2.65	2.11	2.85	.80	2.25	24.67
1915	1.81	2.33	1.12	1.59	5.11	2.98	7.30	4.90	2.58	.64	1.02	2.85	34.23
	6.24	2.94	4.34	4.24	4.24	4.24	4.24	4.24	4.24	4.24	4.24	4.24	33.55

TABLE 25—AMOUNT OF RAINFALL AND WATER APPLIED
APRIL 1 TO AUGUST 31, 1907-1915

	1907	1908	1909	1910	1911	1912	1913	1914	1915
Rainfall April 1 to August 31.....	22.29	19.18	26.69	15.29	10.82	17.39	7.38	11.30	21.88
Acres-inches of water applied.....	None	5.76	3.83	3.67	16.97*	5.28	12.85**	9.52	1.07

*Amount added to Plot 3N in 1911, 14.80 inches.

**Amount added to Plot 3N in 1913, 12.68 inches.

TREATMENT OF PLOTS

Plot 1 was plowed for the oats crop only; that is, but once in each rotation. The vegetation, such as clover or corn stubs, was removed and the corn planted with a hoe. The weeds were kept down by scraping with a sharp hoe so as to produce practically no mulch, and this was done only as often as necessary to kill the young weeds.

Plot 2 was plowed in the spring about 6 inches deep for corn; a good seed bed was prepared before planting the corn, but no cultivation was given after planting. The weeds were kept down in the same way as on Plot 1.

Plot 3S (Plot 3 until 1911) was plowed in the spring and a good seed bed prepared, but after planting the corn, weeds were allowed to grow.

Plot 3N was plowed and a seed bed prepared; weeds were allowed to grow as in 3S, but the plot was irrigated as often as necessary to keep the soil in a moist condition.

Plot 4 was treated the same as Plot 2 except that the corn was given three shallow cultivations with the three-shovel cultivator previous to 1912 and with the surface cultivator after that time. Any weeds that escaped the cultivator were pulled or cut out with a hoe.

Plot 5 was treated the same as Plot 4 except that the crop was irrigated whenever it seemed necessary.

Plot 6 was treated similarly to Plot 5 except that 2 tons of rock phosphate and 30 tons of manure per acre were applied once in each rotation before the second crop of corn.

The treatment of Plot 3 was for the purpose of determining the effect of weeds on the corn crop.

In order to determine whether it was a lack of moisture that produced the low yields where weeds and corn were grown together, Plot 3 was divided in 1911, and the north half was irrigated often enough to keep the soil abundantly supplied with moisture.

EXPERIMENTS IN SOUTHERN ILLINOIS

A series of experiments was conducted at the Fairfield experiment field in Wayne county, on Gray Silt Loam on Tight Clay, the common prairie soil of southern Illinois, to ascertain the relative value of cultivation and thorough seed-bed preparation on that type of soil.

This experiment in general was similar to the one begun at Urbana in 1907, except that irrigation was not practiced. The plots, twelve in number and one-tenth of an acre in size, were arranged in two series, one of which was cropped to corn in 1908 when the experiment was started. According to the records, the 1908 corn yields are unreliable due to damage by livestock, and are therefore omitted. No corn was grown on either series in the years 1909 and 1910. The original four-year rotation of corn, cowpeas, wheat, and clover was changed in 1912 to a two-year rotation of corn and soybeans.

TABLE 26—TILLAGE EXPERIMENTS WITH CORN ON GRAY SILT LOAM ON
TIGHT CLAY AT FAIRFIELD, WAYNE COUNTY, 1911-1914
(BUSHELS PER ACRE)

Plot No.	Treatment	1911	1912	1913	1914	2 Yr.	4 Yr.	Av. % * of Plot 4
1	Not plowed, or cultivated, weeds kept down by scraping with hoe.....	3.2	22.8	0.0	0	13.0	6.5	38.7
2	Plowed, seed bed prepared, no cultivation weeds kept down by scraping with hoe.....	22.1	55.6	0.0	0	38.8	19.4	115.5
3	Plowed, seed bed prepared, weeds allowed to grow.....	8.7	14.6	0.0	0	11.6	5.8	34.5
4	Plowed, seed bed prepared, "ordinary" cultivation.....	25.9	50.4	2.1	0	33.0	16.8	100.0
5	Plowed, seed bed prepared, "ordinary" cultivation, fertilized.....	14.5	41.3	0.0	0			
		32.6	62.1	14.6	0	47.3	27.6	164.3

*Computed from four-year average.

/Manure 80 tons, rock phosphate 2 tons, limestone 5 tons per acre for each rotation.

TABLE 27—RAINFALL AT FAIRFIELD, WAYNE COUNTY, 1911-1914
(INCHES)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1911	1.40	2.19	2.00	6.21	1.20	3.89	.84	2.53	6.80	2.01	2.64	2.91	34.62
1912	1.85	3.09	4.45	5.42	3.20	8.05	7.41	4.87	3.53	.54	2.87	1.58	46.86
1913	10.18	1.05	12.43	3.70	2.30	1.48	1.41	3.46	4.65	4.08	4.40	1.84	50.98
1914	2.30	3.82	3.36	3.36	.12	1.14	1.46	7.15	3.58	3.86	.89	3.27	34.31
Average	3.93	2.54	5.56	4.67	1.70	3.64	2.78	4.50	4.64	2.62	2.70	2.40	41.68

RECENT EXPERIMENTS AT URBANA, ILLINOIS

The most recent experiments on corn cultivation at this station were conducted from 1916 to 1921 inclusive, on the Roland farm, Urbana, which is now a part of the Stadium field. The purpose of this series of experiments was to study the effect upon corn yield of weeds growing unmolested; of surface scraping to eradicate weeds without the formation of mulch; and of shallow cultivation with blade or shovel cultivator. These studies were made on both fertilized and unfertilized plots, arranged in four series of six plots each. The size of the individual plots was one-36.36 of an acre.

The soil on which these experiments were conducted is the morainal Brown Silt Loam, the same type of soil used for the series of cultivation experiments in progress from 1907 to 1915. A four-year rotation of corn, corn, oats, and sweet clover was practiced, with soybeans as a substitute crop when the clover failed in 1916, 1917, and 1919. All cornstalks and residues were removed from those plots which received no treatments of manure, rock phosphate, or limestone. All corn plots were disked, prepared, and planted in the same manner.

TREATMENT OF PLOTS

On Plots 1 and 2 the weeds were allowed to grow. On Plots 3 and 4 the weeds were kept down by scraping with a sharp hoe without forming a mulch. On Plots 5 and 6 the corn was given three or four shallow cultivations, a blade cultivator being used on the north half and a 3-shovel cultivator on the south half of the plots. The average depth of the cultivations was about 1 to 1½ inches for "blades" and 2 to 3 inches for "shovels".

With reference to the fertility treatments, Plots 1, 3, and 5 served as checks in that they received manure in proportion to the crops produced, also 1 ton of rock phosphate and 2 tons of limestone per acre once in a rotation. Manure, equal in weight to all corn (grain), oats (grain and straw), and clover (hay and seed) removed from each plot, was returned to that plot in the spring preceding second-year corn. Applications of phosphate and limestone were made in the fall or early winter previous to the 1916 and 1920 crops.

TABLE 28—CULTIVATION EXPERIMENTS WITH CORN ON FERTILIZED AND UNFERTILIZED BROWN SILT LOAM AT URBANA, 1916-1921 (BUSHELS PER ACRE AS AN AVERAGE OF TWO PLOTS)

Plot No.	Treatment							Av. % of Shovel cultivated plots	
		1916	1917	1918	1919	1920	1921	6 Yr.	Unfert. Fert.
	Weeds allowed to grow.....Unfertilized	.05	13.1	1.9	2.9	9.6	14.5	7.0	13.7
	Weeds allowed to grow.....Fertilized	.15	25.3	4.8	4.0	13.7	21.8	11.6	19.5
	Scraped with hoe.....Unfertilized	28.6	66.1	59.7	56.0	56.4	53.1	53.3	104.3
	Scraped with hoe.....Fertilized	29.8	65.3	62.4	61.6	61.3	53.5	55.6	93.4
N	Cultivated—blades.....Unfertilized	32.0	60.7	56.2	61.2	51.4	56.4	53.0	103.7
S	Cultivated — shovels.....Unfertilized	32.6	59.6	55.1	55.5	50.2	53.4	51.1	100.0
N	Cultivated — blades.....Fertilized	33.4	64.1	64.7	61.4	60.0	64.9	58.1	97.6
SS	Cultivated—shovels.....Fertilized	36.5	37.5	62.1	57.0	67.9	65.8	59.7	100.0

TABLE 29—RAINFALL AT UNIVERSITY OF ILLINOIS, 1916-1921 (INCHES)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1916	6.02	.63	1.14	1.28	5.70	3.88	.73	1.46	2.69	2.26	1.93	1.99	29.71
1917	1.07	.45	4.43	3.62	4.55	6.45	2.73	3.80	2.01	2.34	.18	.60	32.23
1918	1.74	1.86	1.57	6.84	4.64	5.69	2.25	5.15	4.97	2.82	1.73	3.99	43.25
1919	.21	1.92	4.12	.75	3.29	6.90	2.66	3.85	2.47	5.59	3.37	.12	35.25
1920	.83	.45	3.40	5.71	3.78	.94	3.19	3.08	1.79	2.02	1.29	2.81	29.29
1921	1.60	.49	5.82	5.25	5.26	1.68	2.54	4.36	.554	2.23	4.91	1.98	41.66
Average	1.91	.97	3.41	3.91	4.54	4.26	2.35	3.62	3.24	2.88	2.23	1.91	35.23

Reference: Illinois Agricultural Experiment Station Bulletin 259, pages 175, 177, 178, 179, 180, 182, 184, 185, 186, 187, 190, 191, 192, 193, 194 and 195, tables 1, 2, 3, 5, 6, 7, 8, 9, and 11, March 1925, "The Cultivation of Corn, Weed Control versus Moisture Conservation", Urbana, Illinois.

IX

CULTIVATION OF CORN IN NEBRASKA—11 YEARS

Table 30 summarizes an 11-year test designed to develop the principles of cultivation. These tests, which were surface-planted at the rate of 3 plants per hill, may be described as follows:

- (1) No cultivation. The plats were left untouched after planting and weeds allowed to grow.

Normal cultivation. This consisted of ordinary cultivation with a standard six-shovel cultivator, approximating 5 inches deep 9 inches from the plants. This kind of cultivation was performed 1, 2, 3, and 4 times, respectively, on different plats as indicated in the table.

- (3) Continued late cultivation. This involved four normal cultivations followed by one or two additional cultivations with a one-horse cultivator.
- (4) Scraped. The plats were not cultivated but the surface of the ground was merely scraped with a garden hoe at necessary intervals to control weeds.
- (5) Surface cultivation. Given four times with a cultivator having flat, blade-type shovels.
- (6) Shallow cultivation. (Four inches deep 9 inches from the plants)
- (7) Deep cultivation (Six inches deep 9 inches from the plants)
- (8) Close cultivation (Five inches deep 7 inches from the plants)
- (9) Two harrowings followed by two cultivations.

For other conditions in regard to this experiment, see explanation accompanying Table 8.

TABLE 30—THE RELATION OF MANNER AND FREQUENCY OF CULTIVATION
TO THE YIELD AND GROWTH OF CORN, 1922-1932

Manner and Frequency of Cultivation	Yield of Shelled Corn Per Acre—Bushels											
	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	Ave.
None	11.4	6.5	4.5	3.9	0	16.4	.....	.....	.....	.....	.....	.....
1 normal	31.2	29.4	14.6	12.5	0	41.7	.....	.....	.....	.....	.....	.....
2 normal	44.0	42.5	24.3	37.2	0	53.8	22.0	52.2	9.5	14.4	47.1	31.5
3 normal	44.3	46.3	26.3	41.2	0	57.4	22.0	50.7	9.2	19.9	48.2	33.2
4 normal	45.0	50.3	28.0	40.3	0	59.4	23.6	48.6	10.5	19.9	48.6	34.0
4 normal and continued Late *	43.3	46.1	24.6	40.4	0	57.0	24.1	50.21	9.2	21.4	50.6	33.4
Scraped	42.3	50.0	25.2	33.0	0	59.8	12.2	51.9	7.6	17.9	27.1	29.7
4 surface .....	.....	.....	.....	.....	.....	.....	.....	51.4	9.6	19.4	41.6	.....
4 shallow	40.0	50.1	24.6	39.5	0	60.6	18.2	52.6	9.7	19.1	47.0	32.9
4 deep	49.0	49.5	29.2	39.7	0	61.0	26.0	47.7	13.1	20.2	51.3	35.2
4 close	41.5	49.4	30.4	37.1	0	58.8	25.3	56.8	12.2	22.3	45.5	34.5
2 harrowings and 2 normal .....	.....	.....	.....	.....	.....	.....	26.6	57.2	11.3	20.3	35.6	.....

*Four normal cultivations followed by one or two additional cultivations with a one-horse cultivator.

Reference: Nebraska Agricultural Experiment Station Bulletin 293, pages 5, 14 and 15, table 7, January 1935, "Cultural Practices in Corn Production", Lincoln Nebraska.

X

CULTIVATION OF CORN IN OHIO—7 YEAR AVERAGE

Experiments on the cultivation of corn have been conducted for 7 years at Columbus. Many experiments have indicated that weed control is the chief purpose of cultivation and that yields of corn are not increased by more cultivation than is necessary to control weeds. This conclusion has not been borne out by farm experience under all conditions. The aim of the work at Columbus has been to ascertain, if possible, whether weed control is the chief purpose of cultivation, and if it is not, what the other functions of cultivation are.

PLAN OF EXPERIMENTS AT COLUMBUS

The various treatments have been:

1. Weeds removed from the soil by scraping with a hoe, so as to disturb the soil as little as possible.
2. Cultivation of average depth (2"-3"), sufficient to control weeds, usually three times. This was supplemented by hoeing if needed.
3. More cultivation than enough to control weeds, usually four times.

The plots have consisted of five rows, 3 or 3½ feet apart, varying in length in different years from 75 to 110 feet, planted usually in three replications. Only the center three rows have been harvested for yield. Nearly perfect stands have been obtained by planting thick and thinning.

The scraping treatment was included not as an example of farm practice but to eliminate weeds without disturbing the soil in order to answer the question,—“Does cultivation while, or in addition to, destroying weeds benefit the corn crop in some way other than by destroying weeds?”

in treatment 3 (cultivated beyond weed control) a dummy plot has been made to keep the soil surface broken but not in a dusty condition. Usually four cultivations have been enough to do this; in some years five cultivations were made.

The experiment was begun in 1926 on a Miami silty clay loam soil and since 1927, has been cultivated on the Brookston silt clay loam. The former is a light-colored soil inclined to pack or bake during the growing season; whereas the Brookston is a fairly deep, dark, loose soil high in organic matter. Both types are common in west central Ohio.

TABLE 31—CULTIVATION OF CORN AT COLUMBUS, OHIO

Plot and Treatment	Miami silty clay loam								Brookston silty clay loam							
	1926	1927	1928	1929	1930	1931	1932	6 Yr.	7 Yr.	1927	1928	1929	1930	1931	1932	6 Yr.
	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.
1. Weeds eradicated by scraping with hoe	35.0	48.0	64.7	61.4	16.6	79.5	67.8	56.3	53.3	67.4	72.7	65.0	42.1	81.3	104.6	72.2
2. Cultivated enough to control weeds	45.3	59.1	66.8	60.1	16.0	86.4	69.7	59.7	57.6	66.2	67.7	63.0	40.2	76.9	105.1	69.8
3. Cultivated more than No. 2	.....	65.4	66.4	64.5	18.7	85.7	74.3	62.5	.....	67.2	73.6	60.9	44.3	78.5	105.1	71.6
Acre Yields of Fodder — Air-Dry Weights																
	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
1. Weeds eradicated by scraping with hoe	5170	4980	10630	6710	2630	7410	8640	6833	6595	6570	10030	6640	6270	9160	11340	8335
2. Cultivated enough to control weeds	6610	6170	11100	7040	2980	8240	8300	7305	7205	7020	10210	6590	6390	9100	11470	8463
3. Cultivated more than No. 2	.....	7200	11170	7440	3020	8240	9110	7700	.....	7040	10510	6390	6620	8880	11610	8409

An effort has been made to ascertain by sampling and analysis whether or not the increase in corn yields on the Miami soil has been caused by the conservation of soil moisture or the liberation of nitrates. There has been no indication of a higher nitrate content in the cultivated plots than in the scraped plots on either soil; there has been evidence of a higher moisture content in the cultivated plots, especially on the Miami soil.

As a 5-year average (two or three sampling dates each season) the cultivated plots on the Miami soil have contained 16.1 per cent moisture and scraped plots 14.7 per cent. Estimated from its moisture equivalent, this soil would contain at the wilting point about 13.7 per cent moisture. For Brookston soil the corresponding percentage are: cultivated, 19.4; scraped, 18.7; wilting point, about 16.3. Although the absolute difference in moisture content for the two methods of cultivation appear small, the actual difference in the amounts of water available to the crop may have been considerable.

Reference: Ohio Experiment Station: Bimonthly Bulletin Vol. XVIII, No. 162, May-June, 1933, pages 75, 76 and 77. table 1, Wooster, Ohio.

XI

TABLE 32—DEEP, ORDINARY, AND SHALLOW CULTIVATION FOR CORN AT
WOOSTER, OHIO.

YIELDS OF EAR CORN AND STOVER

Year	Deep 4 to 5 in.		Ordinary 2 to 3 in.		Shallow 1 to 2 in.	
	Ear Corn	Stover	Ear Corn	Stover	Ear Corn	Stover
1925	114.5	4884	115.2	5175	112.7	5544
1926	89.9	3523	101.4	4520	93.3	3673
1927	78.4	5152	77.4	4676	78.6	4620
1928	50.1	4408	79.1	3612	37.0	3176
1929	38.7	2548	39.6	2760	23.5	2243
1930	39.4	4652	34.2	4732	36.8	3860
1931	74.7	5256	77.0	5412	74.2	5828
1932	50.2	4080	53.8	4072	55.9	3784
8-year average	67.0	4313	72.2	4370	64.0	4091

In 1928 and 1929, the yields resulting from shallow cultivation were very low. The corn had a pale green color and showed symptoms of a lack of nitrogen. The weather during May and June both years was unfavorable to the development of soil nitrates. Temperatures were much below normal and rainfall high. Under these conditions shallow cultivation failed to aerate the soil so that nitrification could take place.

Deep cultivation has been generally less desirable than ordinary cultivation because of excessive root pruning.

Reference: Ohio Agricultural Experiment Station Special Circular 46, page 37, table 46, June 1935, "Handbook of Experiments in Agronomy", Wooster, Ohio.

XII

TABLE 33—EFFECT OF THREE EXTRA CULTIVATIONS ON CORN IN JULY,
AND AUGUST WITH ONE-HORSE CULTIVATOR, WOOSTER, OHIO

Year	Yield Per Acre	
	Cultivation	
	Ordinary Bushels	Late Bushels
1913	73.7	75.1
1914	46.5	52.0
1916	59.3	58.7
1917	93.9	93.5
1921	94.1	95.0
1922	83.9	75.1
1923	78.9	82.1
Average	75.7	75.9

Reference: Ohio Agricultural Experiment Station Special Circular 46, page 38, table 46, June 1935, "Handbook of Experiments in Agronomy", Wooster, Ohio.

C. TOPPING CORN AND PULLING FODDER

I

TOPPING AND STRIPPING CORN AT STATE COLLEGE, MISSISSIPPI, 1891-94

Topping corn has been tried at this station during three seasons, the tops being removed after the corn has been well glazed. The average loss in the total feeding value of the crop has been more than twenty per cent. The records of seven other stations where similar work has been done show the average yield of the fields which were topped to have been 68.3 bushels per acre, while the untouched check plots averaged 81.3 bushels, a loss of sixteen per cent from topping. At only one station of the seven did the topped plots give the larger yield.

In the work which has been done at this station stripping the leaves has caused an average decrease of over eighteen per cent in the yield of corn.

Reference: Mississippi Agricultural Experiment Station Bulletin 33, pages 63 and 64, March 1895, "Corn", Agricultural College, Mississippi, (State College, Miss.)

II

CUTTING AND TOPPING CORN AND PULLING FODDER AT STATE COLLEGE, MISSISSIPPI, 1899

This experiment was undertaken to determine the loss of grain by cutting the entire plant, topping stalks or pulling fodder. The average of three duplicate tests give the following results.

Operation	Yield of stalks Tops or Fodder (Lbs.)	Yield of Shelled Corn (Bushels)
Stalks left to mature ear.....	.....	36
Stalks (entire plant) cut.....	2218	29.5
Fodder pulled	478	33.3
Tops cut above the ear.....	919	31.3

Reference: 13th Annual Report, Mississippi Experiment Station, June 1900, Mississippi A. & M. College, (State College), Mississippi.

III

PULLING FODDER VERSUS NOT PULLING AT SIX STATIONS

Many arguments have been held over the advisability of "pulling fodder" as a means of providing roughage for work stock. Tests have been made at several agricultural experiment stations to determine the effects on the yield of grain and to determine the quality of roughage provided by using the various methods of harvesting. The data from these tests are assembled in table 34.

TABLE 34—EFFECTS OF HARVESTING METHODS ON YIELDS OF CORN

Place	Date	Fodder Not Pulled Grain	Fodder Pulled Grain	Fodder Pulled Fodder	Corn Cut		Tops Cut	
		(Bu.)	(Bu.)	(Lbs.)	Grain (Bu.)	Stover (Lbs.)	Grain (Bu.)	Top (Lbs.)
Alabama (Canebrake Sta.)	1898	16.97	21.78	.....	.....	.....	22.32	.....
	1898	17.35	16.20	.....	.....	.....	15.68	.....
	1898	21.88	16.0	.....	.....	.....	21.20	.....
Alabama (Auburn Sta.)	1896	34.4	.....	.....	29.2	2103	30.2	311
	1897	31.0	.....	.....	29.5	1355	29.2	501
	1900	46.9	45.9	615	44.3	1759	44.3	711
	1904	25.7	25.5	415	25.4	1980	26.1	361
Arkansas	1892	22.16	19.67	443	19.19	1776	21.85	431
Georgia	1890	20.82	18.74	416	.....	.....	.....	.....
	1891	27.3	23.9	270	.....	.....	.....	.....
	1893	34.95	31.43	665	.....	.....	.....	.....
	1894	38.05	30.28	587	.....	.....	.....	.....
	1895	34.2	34.2	713	34.3	2387	.....	.....
	1899	21.23	.....	.....	21.96	2020	.....	.....
	1900	45.43	47.24	585	48.74	3037	.....	.....
	1901	19.53	19.80	660	19.03	1905	.....	.....
	1903	34.60	34.31	559	35.03	2700	.....	.....
South Carolina	1892	18.9	16.3	.....	.....	.....	.....	.....
Texas	1891	17.22	15.9	427	.....	.....	17.45	10.9

The results shown in Table 35 are summarized to show comparative results from various harvesting methods.

TABLE 35—COMPARATIVE EFFECTS OF HARVESTING METHODS ON YIELDS OF CORN
YIELDS OF GRAIN AND ROUGHAGE

	No. Com- pari- sons	Fodder Not Pulled Grain	Fodder Pulled Grain	Fodder Pulled Fodder	Corn Cut		Tops Cut	
		(Bu.)	(Bu.)	(Lbs.)	Grain (Bu.)	Stover (Lbs.)	Grain (Bu.)	Top (Lbs.)
Fodder not pulled versus Fodder pulled	16	27.31	26.07	530	.....	.....	.....	.....
Fodder not pulled versus Corn cut	10	31.51	.....	.....	30.69	2102	.....	.....
Fodder not pulled versus Tops cut	9	25.95	.....	.....	.....	.....	25.37	57
Fodder not pulled versus Fodder pulled versus Corn cut	7	32.64	32.37	570	32.28	2220	.....	.....

Reference: Agricultural Education, Volume 10, No. 2, October 1933, pages 29 and 30
tables 23 and 24, Clemson College, South Carolina.

IV TOPPING CORN AT TEMPLE, TEXAS

For two years every other row of corn planted in rotation studies has been topped just above the ears as the tops are beginning to mature. The two year average acre production of air dry tops has been 716 pounds of excellent feed. Topped rows yielded grain at a rate of 16.1 bushels per acre, and the untopped have yielded at a rate of 16.5 bushels.

Reference: Texas Agricultural Experiment Station 47th Annual Report, page 168, College Station, Texas.

SUCKERING CORN AT STATE COLLEGE, MISSISSIPPI

	Yield in Bushels Per Acre		
	1910	1912	Average
Suckered 4 feet high.....	29.5	38.5	34.
Suckered 6 feet high.....	29.4	38.	33.7
Unsuckered	37.8	40.5	39.1

Reference: Mississippi Agricultural Experiment Station Bulletin 170, pages 9-10, tables 10 and 11, January 1915, "Corn", State College, Mississippi.

**A Compilation of
Experimental and Other
Data on**

**SWEET POTATO
VARIETIES AND CULTURAL
PRACTICES**

Compiled By

C. F. CLARK

Coordinator Research Information

Jointly Representing

Mississippi Agricultural Experiment Station
and

Mississippi State Vocational Board

J. R. Ricks, Director

Mississippi Agricultural Experiment Station
State College, Mississippi

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A. SWEET POTATO VARIETIES

What are the more productive varieties for early market?

What are the more productive varieties when allowed to grow to maturity?

What is the most desirable variety for home and farm use?

For local market?

For shipping?

Which of the varieties have less rot in storage?

I.

TABLE 1.—SWEET POTATO VARIETY TEST AT STATE COLLEGE, MISSISSIPPI, 1925-1929

Variety	1925	1926	Yield in Bushels Per Acre			5 Yr. Average
			1927	1928	1929	
Triumph	400	460	244	289	422	363
Porto Rico	374	381	268	270	407	340
Nancy Hall	351	257	213	252	307	276
Bunch Yam	145	177	87	105	92	121
Bunch Porto Rico.....		157	282			
Priestley					71	

Size of Plots—1/6 acre.

The results are an average of 3 plantings in 1925, 2 in 1926, 1 in 1927, 3 in 1928 and two plantings in 1929.

Reference: Mississippi Agricultural Experiment Station Bulletin 279, page 4, table 1, August 1930, "The Production and Storage of Sweet Potatoes", State College, Mississippi.

These calculations were made on the basis of 50 lbs. per bushel. The calculations in Bulletin 279 were made on the basis of 56 pounds.

II.

TABLE 2—SWEET POTATO FIVE YEAR VARIETY TEST AT HOLLY SPRINGS, MISSISSIPPI

Variety	1913	1915	1916	1920	1921*		5 Yr. Av'ge.
					Early	Late	
Trimuph	224	337	229	384	303	241	295
Dooly Yam	144	301	148	193	279	122	213
Gold Coin	170	301	250				
Porto Rican Yam.....		299	206	339	356	201	
Nancy Hall	173	290	188	310	236	162	239
Southern Queen	109	283	167				
Bunch Yam	166	237	128				
Common Running Yam.....	66	134	148				

*The early plot was planted on June 8 and harvested on October 16. The late plot was planted on June 24 and harvested on October 26. The early plot followed strawberries, while the late plot followed wheat and vetch hay. A perfect stand was secured with each planting.

Soil—Grenada silt loam of ordinary fertility..

Plots—One row each repeated 5 times. Three different plots of ground were used in the test.

Rows—3½ feet, plants 18 inches apart in the row.

It was necessary to do some replanting each year to secure a good stand.

Fertilizers—An average of 200 pounds cottonseed meal and 200 lbs. super-phosphate per acre was used each year.

References: Mississippi Bulletin 192, page 14, table 5, "Report from Holly Springs Branch Experiment Station from 1915 to 1920 Inclusive", December 1920, Mississippi Bulletin 202, page 18, table 8, "Report of the Holly Springs Branch Experiment Station for 1921, December 1921.

III.

TABLE 3—SWEET POTATO VARIETY TEST AT HOLLY SPRINGS, MISSISSIPPI, FIVE YEARS

Variety Used	Average Yield in Bushels					
	1921	1922	1923	1924	1925	5 Yr. Av'ge.
Nancy Hall	198.7	150.4	142.9	217.3	225.7	187.0
Triumph	271.8	178.8	195.2	224.5	230.3	220.1
Porto Rican Yam	278.8	191.4	133.3	135.2	250.4	197.8
Dooley Yam	200.2	125.1	177.1	178.6	294.1	195.0

Soil type—Either Lexington or Lintonia silt loam (terrace or second bottom land).

Size of Plots—1921, early planted plot, 1/44 acre, late planted plot, 1/31 acre, 1923, 1/19 acre.

Row width—3½ feet.

Spacing of Plants in Row—18 inches.

Fertilizer—1921, 200 pounds cottonseed meal and 200 pounds superphosphate applied before planting; 1923, 300 pounds superphosphate, 150 pounds nitrate of soda and 100 pounds kainit.

Planting dates—1921, one plot planted on June 8 and another planted on June 24. The two plots are averaged. 1923, June 25.

Harvesting dates—1921, early planted plot, October 16; late planted plot, October 26. 1923, October 23.

Reference: Mississippi Agricultural Experiment Station Bulletin 233, table 16, page 21, December 1925, "Report from Holly Springs Branch Experiment Station for 1925", State College, Mississippi.

IV.

TABLE 4—YIELDS OF THREE VARIETIES OF SWEET POTATOES ON RUSTON FINE SANDY LOAM AT POPLARVILLE, MISS.

Variety	Yield in Bushels Per Acre													
	Marketable										Total			
	1919	1920	1921	1925	1929	1930	Av'ge.	1919	1920	1921	1925	1929	1930	Av'ge.
Porto Rico	92	161	120	194	255	256	179.6	125	196	155	300	337	273	231.0
Nancy Hall	63	55	72	80	134	232	106.0	97	91	113	140	199	248	148.0
Triumph	117	157	87	172			133.2*	157	211	113	282			190.7*

*Average of four years.

Conditions under which experiment was run:

Seed—1919—Seed were treated with bichloride of mercury before bedding.

1920—Nancy Hall seed rotted in bed to the extent that vine cuttings had to be used to supplement plants, apparently this greatly reduced the yields.

1921—Plants were sent from Holly Springs experiment station.

Fertilizer—1919—400 pounds per acre of a mixture of 2 parts super-phosphate and 1 part cottonseed meal applied in drill. 1925—500 pounds 4-8-8 fertilizer. 1930—300 pounds 4-8-4 fertilizer.

Planting Date—1921—July 8, 1925—April 8, 1930—May 20.

Width of rows—1919—3½ feet, 1921—4 feet.

Spacing of plants in row—1921, 15 inches.

Harvesting Date—1919—November 28, 1921—November 25, 1925—October

7.

References: Mississippi Experiment Station Bulletin 194, page 23, table 8, 1920; Mississippi Experiment Station Bulletin 201, page 18, 1922; Mississippi Experiment Station Bulletin 232, page 9, 1925; Mississippi Experiment Station Bulletin 274, page 33, table 37, 1929; Mississippi Experiment Station Bulletin 285, page 27, table 41, 1930; "Reports of the South Mississippi Branch Experiment Station".

V.

TABLE 5—SWEET POTATO VARIETY TEST, STONEVILLE, MISSISSIPPI, 1920

Variety	Bushels Per Acre	
	Marketable	Total Yield
Triumph	412	547
Nancy Hall	315	439
Dooley	322	372
Golden Coin	308	344
Porto Rico	293	335
Bunch Yam	138	199

Reference: Mississippi Bulletin 210, page 11, table 5, March, 1922; "Vegetables and Truck for Home Use", State College, Mississippi.

VI.

TABLE 6—LATE MATURITY OF SWEET POTATO VARIETIES AT TIFTON, GEORGIA

Average Yields for Six Years, 1922 to 1927, Inclusive

Fertilizer—500 pounds per acre analyzing 9% Phosphoric Acid, 1.66% Nitrogen and 3% Potash.

Average Date Planted—April 25th.

Average Date Harvested—November 3rd.

Average Number Growing Days—193.

Variety	Yield in Bushels Per Acre					Total
	No. 1's	No. 2's	Strings	Jumbos	Field Rot	
1. Southern Queen	152.59	31.45	20.48	16.72		221.25
2. Triumph	143.85	29.25	18.17	8.29	.94	200.50
3. Porto Rico	121.99	24.18	19.34	18.20	1.65	185.36
4. Nancy Hall	110.82	38.36	22.61	3.15		174.94*
5. Pumpkin Yam	86.30	38.01	17.89	2.47	1.61	146.28
6. Dooley Yam	83.60	34.91	15.58	2.37	.14	136.60
7. Yellow Yam	70.87	31.89	18.54	.85		122.15
8. Purple Yam	69.84	43.39	21.06	.31	2.43	137.03**
9. Norton Yam	59.99	27.53	16.09	3.71		107.32*

*Five-year average.

**Four-year average.

Soil Type—Tifton sandy loam. The soils of the Tifton series are very similar to those of the Norfolk.

Reference: Georgia Coastal Plain Experiment Station, Bulletin No. 17, Page 10, Table II (A), February, 1932. "Sweet Potato Culture in the Coastal Plain of Georgia". Tifton, Georgia.

VII.

TABLE 7—LATE MATURITY OF SWEET POTATOES, AT TIFTON, GEORGIA

Same as Table 6, Showing Yields of No. 1's by Years as Indicated

Variety	Yield in Bushels No. 1's Per Acre					
	1922	1923	1924	1925	1926	1927 6 Yr. Av'ge.
1. Southern Queen	100	154	203	90	173	195
2. Triumph	142	80	183	107	183	169
3. Porto Rico	130	112	99	85	186	119
4. Nancy Hall	74	80	169	88	143	111**
5. Pumpkin Yam	89	86	126	76	82	59
6. Dooley Yam	122	83	95	69	68	64
7. Yellow Yam	55	77	94	36	71	93
8. Purple Yam	131	51	83	15		70*
9. Norton Yam	71	70	77	38	44	60**

*Four-year average.

**Five-year average.

Reference: Georgia Coastal Plain Experiment Station, Bulletin No. 17, Page 11, Table II (B), February, 1932. "Sweet Potato Culture in the Coastal Plain of Georgia". Tifton, Georgia.

VIII.

TABLE 8—STORAGE TEST WITH SWEET POTATO VARIETIES AT TIFTON, GEORGIA

Per Cent Rot for Six Years, 1922 to 1927, Inclusive

Potatoes Grown from Draws. Ninety Days in Storage.

Variety	6 Year Average Per Cent Rot
1. Southern Queen	7.7
2. Triumph	8.6
3. Nancy Hall*	14.0*
4. Dooly Yam	15.6
5. Schroer's Early	18.3
6. Norton Yam**	19.0**
7. Porto Rico	21.4
8. York Yam	22.5
9. Golden Beauty	23.9
10. Yellow Yam	25.1
11. Pumpkin Yam	26.0
12. Jerusalem Yam	36.3
13. McMillan Cluster	38.2
14. Hardshell	42.0
15. Purple Yam**	43.0**
16. Big Stem Jersey	49.2

*Five-year average.

**Four-year average.

Each variety of sweet potatoes that was included in the variety trial was graded and placed in storage immediately after being dug and was allowed to remain there until the potatoes were removed at bedding time in the spring. The period of storage was approximately 90 days. The potatoes used in this test were grown from draws. The curing house was a tobacco barn. The only change necessary in converting the barn into a curing house is that of putting in a temporary floor on the first tier poles. The principal objection to this type of storage house is that the temperature fluctuates more than in a specially constructed house. This condition makes it necessary to give the potatoes more careful attention during the winter months when freezing is likely to occur.

THE POTATOES WERE CURED AS FOLLOWS:

During the Curing Period.

1. A temperature of 80 to 90 degrees F. was maintained during the curing period, which is usually 10 to 15 days.
2. Thorough ventilation was given during the day, but the temperature was not allowed to fluctuate.
3. The floor ventilators were closed at night if there was danger of frost.
4. During severe weather all ventilators in floor and roof were closed.
5. When the curing period was over (indicated by sprouting or a purplish blue spot at the buds) the temperature was gradually reduced by slowly discontinuing the fire.

After the Curing Period.

1. A dry atmosphere and uniform temperature were maintained.

2. As often as weather conditions permitted, the ventilators, and outside doors and windows were opened, but closed completely early in the afternoon.
3. During wet weather when the house appeared damp, the ventilators were opened and a slow fire was kept until all dampness had been driven out.
4. During severely cold weather, a slow fire was kept to prevent the potatoes from freezing.
5. One person was entirely in charge of the house.

Reference: Georgia Coastal Plain Experiment Station, Bulletin No. 17, Pages 46, 47 and 48, Table XXVI, February, 1932. "Sweet Potato Culture in the Coastal Plain of Georgia". Tifton, Georgia.

IX.

**TABLE 9—EARLY PRODUCTION OF SWEET POTATO VARIETIES
AT TIFTON, GEORGIA**

Average Yields for Eight Years, 1924 to 1931, Inclusive

Fertilizer—800 pounds per acre analyzing 8% Phosphoric Acid, 3.3% Nitrogen and 4% Potash.

Average Date Planted—April 3rd.

Average Date Harvested—August 7th.

Average Number of Growing Days—117.

	Variety	Yields in Bushels Per Acre					Total
		No. 1's	No. 2's	Strings	Jumbos		
1.	Southern Queen	98.22	17.52	13.75	5.50		134.99
2.	Porto Rico	97.28	20.09	17.94	5.20		140.51
3.	Triumph	84.04	16.79	15.62	3.11		119.56**
4.	Bunch Porto Rico	69.31	12.21	12.64	2.45		96.61***
5.	Nancy Hall	66.04	19.91	13.47			99.42***
6.	Yellow Yam	56.25	20.86	21.57			98.68/
7.	Big Stem Jersey	46.26	19.37	35.75	.42		101.80//
8.	Pumpkin Yam	30.10	11.34	16.44			57.88**

/Three-year average.

***Four-year average.

**Five-year average.

*Six-year average.

//Seven-year average.

Soil Type—Tifton sandy loam.

Reference: Georgia Coastal Plain Experiment Station, Bulletin No. 17, Page 7, Table 1 (A), February, 1932. "Sweet Potato Culture in the Coastal Plain of Georgia". Tifton, Georgia.

X.

**TABLE 10—EARLY PRODUCTION OF SWEET POTATO VARIETIES
AT TIFTON, GEORGIA**

Same as Table 9, Showing Yields of No. 1's by Years as Indicated

	Variety	Yield in Bushels No. 1's per Acre								8 Yr. Av.
		1924	1925	1926	1927	1928	1929	1930	1931	
1.	Southern Queen	59	94	134	64	90	118	108	119	98
2.	Porto Rico	76	59	114	195	58	101	74	101	97
3.	Triumph		68		125	64		67	98	84**
4.	Bunch Porto Rico			78	49	41	109			69***
5.	Nancy Hall	48	84	76		56				66***
6.	Yellow Yam		21	65	83					56/
7.	Big Stem Jersey		32	61	92	50	27	10	52	46//
8.	Pumpkin Yam		25	48		28		8	41	30**

/Three-year average.

***Four-year average.

**Five-year average.

*Six-year average.

//Seven-year average.

Reference: Georgia Coastal Plain Experiment Station, Bulletin No. 17, Page 8, Table 1 (B), February, 1932. "Sweet Potato Culture in the Coastal Plain of Georgia". Tifton, Georgia.

XI.

VARIETY TESTS OF SWEET POTATOES AT EXPERIMENT, GEORGIA, 1912

In the test of 1912, there were 21 varieties. A 4-8-7 fertilizer was used at the rate of 1,040 pounds per acre. Mention is made of the six varieties which gave the largest yield, and one variety which gave the smallest yield per acre.

Triumph	457.1 bushels
Golden Beauty	369.6 bushels
Jerusalem Yam	334.5 bushels
Triumph No. 2	310.8 bushels
Enormous	309.8 bushels
Myers Early	301.6 bushels
Vineless Bunch	113.5 bushels

Reference: Georgia Agricultural Experiment Station Twenty-Fifth Annual Report, page 299, 1912, Experiment Georgia.

XII.

COMPARATIVE YIELDS OF BIG STEM JERSEY AND PORTO RICO SWEET POTATOES AT EXPERIMENT, GEORGIA, 1924

During the past season (1924) the Experiment Station has noted the yields, habit of growth and keeping quality of the Porto Rico variety in comparison with the Big Stem Jersey. The yield of the two were:

Porto Rico	271 bushels per acre; 8.4% too small to sell
Big Stem Jersey	367 bushels per acre; 12.6% too small to sell

Reference: Georgia Agricultural Experiment Station Thirty-Seventh Annual Report, page 85, 1924, Experiment, Georgia.

XIII.

TABLE 11—YIELD OF DIFFERENT VARIETIES OF SWEET POTATOES ON THIN NORFOLK SANDY SOILS AT AUBURN, ALABAMA

3 Year Average

Variety	Average Yield in Bushels Per Acre	
	1926-1928 Inclusive	
Bunch Porto Rico	119	
Creola	86	
Dooly	85	
Enormous	70	
Miles Yam	78	
Nancy Hall	91	
Pumpkin	45	
Red Jersey	139	
Porto Rico	148	
Southern Queen	135	
Triumph	134	
Vineless	81	
Yellow Jersey	162	
Yellow Strassburg	65	

Reference: Alabama Agricultural Experiment Station Fortieth Annual Report, page 31, table 11, June 30, 1929, Auburn, Alabama.

XIV.

TABLE 12—SWEET POTATO VARIETY YIELDS, SANDHILL STATION, COLUMBIA, SOUTH CAROLINA—1932-1933

Variety	Total Yield Per Acre Bu.		Per Cent Grading	U. S. No. 1	
	1932	1933		1932	1933
Yellow Jersey	145.8	78.5	112.1	56.2	42.2
Big Stem Jersey	151.0	88.1	119.5	43.2	40.9
Nancy Hall	129.2	139.0	134.1	51.7	48.2
Southern Queen	243.2	167.2	205.2	84.8	65.9
Triumph	232.4	76.8	154.6	78.7	57.2
Porto Rico	129.9	138.6	134.2	78.2	61.9
Norton	289.0	145.3	217.1	85.9	63.6
W. S. Porto Rico	145.9	83.6	114.7	52.2	55.9

Reference: South Carolina Agricultural Experiment Station 47th Annual Report, page 116, table 31, Clemson College, South Carolina.

XV.

AN OBSERVATION AS TO CONSUMER PREFERENCE FOR SWEET POTATOES

For the past twenty-five years the "Jersey" type of Sweet Potato has been greatly preferred in Northern Marketing circles. In some seasons "Jerseys" averaged twice the price of Southern Yams. The potato grown and marketed during these years in the South was principally Nancy Halls. However, for the past five or six years the Porto Rican has been gradually displacing the Nancy Hall. For the last two or three years Porto Ricans have gained in Consumer preference sharply. The past season, for instance, witnessed the movement of about 2,000 cars of Porto Ricans out of Louisiana against about 1,200 cars the previous season. In compliance with this consumer demand, commercial Sweet Potato growers of Mississippi are now changing rapidly from Nancy Halls to Porto Ricans. Porto Ricans, then, are apparently gaining in favor in all markets at a 25 to 50 percent higher price than Nancy Halls.

(T. M. Patterson, Extension Economist, State College, Miss.)

XVI.

SWEET POTATO VARIETY PREFERENCES IN CONSUMING MARKETS

In the markets of the South the Porto Rico is the most popular variety. In other sections of the United States the Nancy Hall is the best known and most popular of the southern varieties. In the eastern markets "north of Virginia and east of Ohio" the dry-fleshed Jersey stock is desired, and there is no decided preference for any one southern variety. In the central or northern markets—north of Tennessee and east of the Mississippi River—the Nancy Hall is the most popular southern variety. Jersey type stock is preferred, but the preference is not so positive as it is in the East. West of the Mississippi River the Nancy Hall is the favorite, but preferences are not so firmly established as in other sections.

In certain markets in all of these groups of States exceptions occur; for instance, in sections that prefer the Nancy Hall there are cities that pay higher prices for the Porto Rico. The Porto Rico has gained rapidly in popularity since 1919, especially in the western markets and to some extent in the East. Existence of market preferences and the fact that they may be changed within a comparatively short time through advertising, changed standards of quality, and other conditions, are factors that vitally affect distribution, sales policies and shipping-point practices. Table 13 shows the answers of 279 representative dealers to the question: What variety of southern sweet potatoes do you prefer to handle?

TABLE 13—RESULTS OF A QUESTIONNAIRE SENT TO 542 SWEET POTATO DEALERS IN PRINCIPAL MARKETS OF 31 STATES, 1921

Question	Eastern Markets (76 Dealers report- ing)	Central Markets (87 Dealers report- ing)	Western Markets (79 Dealers report- ing)	Southern Markets (37 Dealers report- ing)	Total (279 Dealers report- ing)	Percent- age
What variety of Southern sweet potato do you prefer to handle?						
Nancy Hall	33	66	60	12	171	66.8
Porto Rico	21	4	20	28	73	28.5
Other varieties*	9	3			12	4.7
What style of container do you prefer?						
Barrel	39	15	10	6	70	20.9
Bushel crate	13	8	14	9	44	13.2
Bushel hamper	33	63	35	5	136	40.7
Bushel basket	4	8	36	2	50	15.0
5-peck crate	2				2	0.6
Sacks			10	11	21	6.3
Bulk shipment				11	11	3.3
Can you use sweet potatoes over 3½ inches in diameter and 10 inches in length?						
Yes	2			1	3	1.3
No	46	63	58	16	183	81.0
Limited quantity	8	7	14	11	40	17.7

*12 dealers stated that they did not want any southern variety, but preferred stock of the Jersey type from New Jersey, Maryland and Virginia.

Reference: U. S. Department of Agriculture Bulletin 1206, page 8, table 1, March 1924, "Marketing Southern-Grown Sweet Potatoes", Washington, D. C.

XVII. CHARACTERISTICS OF SOME SWEET POTATOES AT EXPERIMENT, GEORGIA

The variety to grow depends upon the purposes for which the potato is to be used. If a grower wishes to supply the Northern market he should select a potato that has a light-colored flesh and is dry and mealy when cooked. To the average Northern family, the ideal potato is the Irish potato. The nearer the sweet potato approaches the Irish potato in texture and flavor, the more salable it will be on the Northern markets. In the South, the demands are different. To the average Southern family, a potato with a rich yellow flesh and very sweet is preferred. A Potato that has a candied appearance after baking, as though it had been dipped in cane syrup, is the ideal potato for the Southern markets.

The following data on varieties grown at the Experiment, Georgia, station during the season of 1912 and 1913 may be of some aid to prospective growers who wish to take yield as well as type and color of flesh into consideration:

TABLE 14—SWEET POTATO VARIETY CHARACTERISTICS

Variety	1912				1913			
	Color of Skin	Color of Flesh	Bushels Per Acre	% Kept Thru Winter	Bushels Per Acre	% Kept Thru Winter	Size Pota- toes	
Big Stem Jersey.....	ly	lc	273.0	47	126.6	36	m	
Buck Yam	y	y	146.9	8	323.3	50	l	
Dooly or Norton Yam.....	y	y	273.0	10			m	
Enormous	ly	c	309.8	46	469.8	26	vl	
Golden Beauty	y	y	369.6	53	415.0	50	l	
Jersey Red	r	lc	190.2	30	144.6	20	s	
Jersey Yellow	ly	lc	334.5	50	185.3	42	m	
Jerusalem Yam	y	y	280.8	13			m	
Myers Early	ly	y	301.6	50			m	
Nancy Hall	ly	y	290.7	57			m	
Pumpkin Yam	y	y	219.7	13	205.1	4	m	
Providence	ly	y	254.3	30	247.5	30	ml	
Porto Rico Yam.....	y	y	277.7	28	260.0	48	l	
Southern Queen	w	w	267.8	60	468.9	60	ml	
Triumph	lc	w	457.1	40	474.6	56	l	
Vineless Bunch	ly	lc	113.5	42	274.9	46	s	
Georgia Yam	c	lc			219.3	50	m	

Reference: Georgia Agricultural Experiment Station Bulletin 107, pages 91 and 92, table 7, March 1914, "Sweet Potatoes, Culture, Storing and Studies in Fertilizing", Experiment, Georgia.

B. SECURING PLANTS OR VINES

How many bushels of potatoes should be bedded for each acre to be set?

What methods may be used for economically securing plants?

From where may desirable seed stock be secured?

Which is more desirable for the earlier plantings, vines or draws? For late plantings?

I.

WHERE TO BUY HEALTHY SEED AND PLANTS

It is illegal to sell seed potatoes or plants in Mississippi unless they have been inspected and certified by the State Plant Board. Growers who desire to qualify for selling seed potatoes or plants should apply to the office of the State Plant Board at State College before July 1 of each year. Inspections are made of the potatoes in the field, in the storage house and of the plants on the plant beds. Lists of certified seed and plant growers are prepared each season and may be obtained by writing the Plant Board at State College, Mississippi.

Clay Lyle, Entomologist, Mississippi State Plant Board
State College, Mississippi

II.

BEDDING

There are several things that must be taken into consideration in order to get good, healthy plants for setting. An important factor is the kind of bed used. There are several types: the old fashioned bed made by mixing well-rotted manure and soil and bedding late in Spring; the manure-heated hot-bed; the fire-heated hot-bed; and the solar-heated hot-bed.

The first type is not desirable for two reasons; first, no heat is generated to warm up the tuber and cause it to sprout; second, there is danger of the development of rot in the tubers due to contact of manure with the potatoes.

The potato plant does not draw on the soil for plant food, but uses the food stored up in the tuber; hence cannot make use of the manure in its sprouting.

The second method is the manure-heated hot-bed. Fresh manure is used in this type of hot-bed. The heat generated by fermentation warms up the soil and causes the potato to sprout quickly. A delay in the sprouting of the potato has a tendency to make it more susceptible to rotting.

The flue-heated hot-bed gives a very economical structure for production of potato plants, and its operation cost is low. A cord of wood will furnish enough heat for a bed 60 feet long and 6 feet wide. In comparison with the manure heated hot-bed, this is very cheap, since 15 or 20 loads of manure would be required to furnish the same amount of heat, the manure costing several times as much as the wood.

The solar frame is a frame constructed so as to receive heat from the sun which warms up the soil from beneath and also stores up heat in water, to be released during the night. This method is cheap, the only cost being the sash. The average single sash does not cost any more than one load of manure. The sash may be used for twenty years if taken care of; the manure one season.

Potato plants big enough to be set in the field may be obtained from the hot-beds in approximately 28 days. Plants have been repeatedly taken from flue-heated hot-beds in 27 days from the time potatoes were bedded; however, comparisons show that the solar frame will produce plants just as quickly and of as good quality.

In bedding potatoes, the medium sized, smooth, sound potatoes should be used. Size of potatoes bedded has no effect on size of potatoes eventually produced, but does have an effect on number of pullings possible. For four years potatoes were grown from the smallest strings that could be selected. Another plot was planted from the largest Jumbos that could be selected. At digging time, from each plot, selections were made, the small strings from the "string" plot and the Jumbos from the "Jumbo" plot. At the end of the fourth year three disinterested parties could not tell which was the "String" plot and which the "Jumbo" plot, when the potatoes were dug and strung out along the rows.

The beds should be looked after daily and watered whenever necessary. The plants should be removed from the bed when they have reached a length of three or four inches and have from three to five good leaves. A bed properly tended will produce an average of 2,000 plants from a bushel of potatoes bedded. One expecting to get 2,000 plants should remove plants from the bed as soon as they are ready to set in the field in order that new plants may be produced. It will require at least three pullings, and sometimes four, from a bed planted with one bushel of potatoes to get 2,000 plants.

Reference: Mississippi Agricultural Experiment Station Bulletin 279, pages 5 and 6, "The Production and Storage of Sweet Potatoes", August 1930, State College, Mississippi.

III. BEDDING

1. Plants required per acre: 30-inch rows, plants 15 inches apart in the row, about 14,000; 18 inches apart, 11,600; 24 inches apart, 8,700; 3-foot rows, plants 12 inches apart, 14,500; 15 inches apart, 12,000; 18 inches apart, 9,000; 24 inches apart, 7,500.

2. One bushel of average size potatoes bedded will cover 10 to 12 square feet of space*; one bushel Jumbos, 6 square feet; one bushel of No. 1's, 8 square feet; one bushel No. 2's, 12 square feet; one bushel seed stock, 20 square feet.

*15 to 18 square feet of space according to T. E. Ashley, Horticulture Department, Mississippi Agricultural Experiment Station.

3. The practice usually is to bed one bushel of seed potatoes for each thousand plants desired at first drawing. One bushel will usually produce 3,000 to 4,000 plants at three drawings. With good seed potatoes and a well made and well managed bed, the average number of plants will run somewhat higher.

4. Plants or draws may be grown for an eighth to a sixth of the area planted, and vine cuttings, used for the remainder. The single leaf cutting 8 to 10 inches is recommended.

Reference: South Carolina Extension Service Bulletin 84, page 27, April 1927, "The Sweet Potato Industry", Clemson Agricultural College, Clemson College, South Carolina.

IV.

HOME-GROWN PLANTS VERSUS SHIPPED PLANTS AT EXPERIMENT, GEORGIA

In the spring of 1912, plants of four leading varieties of sweet potatoes—Golden Beauty, Nancy Hall, Big Stemmed Jersey and Triumph—were ordered from representative Florida growers. The plants arrived May 15th and were set to the field promptly, two rows, 209 feet long, being set to each variety. On the same date plants of the same four varieties were taken from our own beds and set to the field in like manner. As far as possible, the ordered plants and the home-grown plants of the same varieties were grown under the same conditions. The crop was harvested early in November, soon after a light frost, with the following results:

Variety	Pounds Potatoes from Home-grown Plants	Pounds Potatoes from Ordered Plants
Triumph	1055	725
Golden Beauty	853	555
Nancy Hall	771	602
Big Stem Jersey.....	630	533

The yields are decidedly heavier from the home-grown plants than from the plants shipped in from Florida. This may be accounted for in two ways. First, the home grown plants are in better condition for transplanting to the field than it is possible to maintain plants in when shipped long distances. Second, it is possible that the plants, coming from potatoes grown under sub-tropical conditions for a number of years are not fully acclimated to other soil and climatic conditions.

Some evidence may be given to support the latter theory by comparing the yields of a variety for the first and the second year after it has been brought from its native habitat with the same variety that has been grown locally for a number of years.

In the spring of 1909, the originator of the Golden Beauty sweet potato sent the writer a few plants of this variety. They were grown and the seed saved from year to year until the spring of 1912, when the originator again sent plants of the same variety. These plants were grown side by side and under the same conditions as the same variety that had been grown here since 1909. Seed potatoes were saved from both strains of the 1912 crop and home-grown plants were planted from these strains during the season of 1913. The results from the two years' yields are given in the following table:

Variety	Lbs. Marketable Potatoes	Lbs. Small Potatoes	Total Lbs. Potatoes
1912			
Golden Beauty, home grown.....	773	80	853
Golden Beauty, ordered.....	406	149	555
1913			
Golden Beauty, home grown.....	390	49	439
Golden Beauty, with 1 year's acclimation	455	29	484

Reference: Georgia Agricultural Experiment Station Bulletin 107, pages 88, 89 and 90, Tables 4 and 5, March 1914, "Sweet Potatoes, Culture, Storing and Studies in Fertilizing", Experiment Georgia.

V.

**THE INFLUENCE OF NORTHERN AND SOUTHERN GROWN SEED
POTATOES ON SWEET POTATO YIELDS IN THE SOUTH
AT TIFTON, GEORGIA**

This test was conducted in cooperation with the U. S. Department of Agriculture, the latter furnishing the northern grown stock and this station furnishing the southern grown. The purpose of this study was to determine whether or not the section from which the seed stock was procured would influence the yield. This was done in response to a current opinion that seed potatoes which were grown in the North would produce heavier yields in the South than locally grown stock.

**TABLE 15—COMPARATIVE YIELDS OF NORTHERN AND SOUTHERN
GROWN SWEET POTATO SEED STOCKS**

Average Yields for Three Years, 1923 to 1925, Inclusive

Fertilizer—500 pounds per acre analyzing 9% Phosphoric Acid, 1.66% Ammonia and 3% Potash.

Average Date Planted—May 16th.

Average Date Harvested—November 8th.

Average Number Growing Days—177.

Variety	Yield in Bushels per Acre	
	Northern Grown	Southern Grown
	Stock	Stock
1. Southern Queen	151.13	175.35
2. Porto Rico	131.10	135.49
3. Nancy Hall	129.18	129.01
4. Big Stem Jersey	123.84	120.29
5. Dooly Yam	120.73	115.79
6. Triumph	118.08	113.66
7. Yellow Yam	105.09	106.94
8. Pumpkin Yam	70.35	124.03

Reference: Georgia Coastal Plain Experiment Station, Bulletin No. 17, Pages 10 and 12, Table III., February, 1932. "Sweet Potato Culture in the Coastal Plain of Georgia". Tifton, Georgia.

VI.

**TABLE 16—COMPARATIVE YIELDS OF VINES, DRAWS AND WHOLE
POTATOES AT TIFTON, GEORGIA**

Average Yields (Porto Rico), Six Years 1922 to 1927, Inclusive

Fertilizer—500 pounds per acre analyzing 9% Phosphoric Acid, 1.66% Nitrogen and 3% Potash.

Average Date Planted—May 16th.

Average Date Harvested—November 3rd.

Average Number Growing Days—172.

Source of Plants	Yield in Bushels per Acre					Mother Potato	Total
	No. 1's	No. 2's	Strings	Jumbos	Rot		
Draws	83.33	30.16	20.65	.25			134.39
Vines	75.72	26.18	19.65	2.02	2.44		126.01
Whole Potatoes	26.51	10.41	8.32			114.78	160.02

The whole potato continues to grow, setting very few new potatoes, with the result that the heaviest yield falls in Jumbo grade. The Jumbo is in this instance, however, the mother potato which has continued to grow into a rough, irregular, deeply cracked and over-sized potato. This work was also supplemented by planting cut potatoes similar to the cubes into which Irish potatoes are cut for planting. The results were similar to those obtained from planting whole potatoes.

Reference: Georgia Coastal Plain Experiment Station, Bulletin No. 17, Page 14, Table IV., February, 1932. "Sweet Potato Culture in the Coastal Plain of Georgia". Tifton, Georgia.

For other experiments on the use of vine parts as plants see Tables 36 and 37, and last experiment in this bulletin.

VII.

TABLE 17—FLUE-HEATED SWEET POTATO BED RECORD OF ALBERT HUGH HENDERSON, ACKERMAN, MISS. FOR 1932

Materials and Labor	Hours		Cost		Returns	Value
	M	H				
22 bushels seed			\$ 6.50	Set 3 acres 24,000 plants		\$30.00
Tin (and scrap)			1.50	Sold 14,000 plants		17.00
Nitrate of soda			.25	Gave away last pulling		
40 linear ft. of 1"x10" boards			.30	Total		\$47.00
Iron rods and pipe (scrap)			.00			
Hauling dirt	6	3	.75	Remarks		
Making beds	12		1.20	Variety—Nancy Hall, certified and		
Bedding and covering seed	4		.40	dipped when bought.		
Getting wood	10	4	1.20	Bedded 75 feet from a spring.		
Fire (21 days, 20 min.)	7		.70	Soil—Ruston very fine sandy loam,		
				not in		
				Size—9' x 22'.		
Total	39	7	\$12.80	Prepared by S. Buchanan.		

Bedded—March 4, 1932.

First Plants—April 7, 1932.

C. PREPARING THE SEED BED

What is the most desirable bed for setting sweet potatoes?

Is there enough difference in production to warrant a difference in labor that may be required?

I.

TABLE 18—METHODS OF CULTIVATING SWEET POTATOES AT TIFTON, GEORGIA

Average Yields (Porto Rico), 7 Years 1925 to 1931, Inclusive

Fertilizer—800 pounds per acre analyzing 3.3% Nitrogen, 8% Phosphoric Acid and 4% Potash.

Average Date Planted—April 22nd.

Average Date Harvested—November 4th.

Average Number Growing Days—197.

Method	Yield in Bushels per Acre					Total
	No. 1's	No. 2's	Strings	Jumbos	Rot	
High Bed, cultivated	95.15	23.52	21.26	1.03	.14	141.11
Standard Bed,						
Subsoiled and cultivated	85.96	24.01	21.43	2.26	.53	134.19
Level (no Bed), cultivated	81.89	17.69	16.58	2.20	.74	119.10
Standard Bed, cultivated	79.62	22.61	23.84	2.94	2.11	131.12
Standard Bed, uncultivated	77.93	21.21	16.71	.89	1.47	118.21

These ridges were thrown up with a two-horse turn plow, thus obtaining the greatest height that could be secured with this implement, in three and

one-half foot rows. The beds in this area ranged from 12 to 15 inches in height, while the standard beds were about eight inches high.

Reference: Georgia Coastal Plain Experiment Station, Bulletin No. 17, Pages 39 and 40, Table XXIII., February, 1932. "Sweet Potato Culture in the Coastal Plain of Georgia". Tifton, Georgia.

II.

SWEET POTATOES PLANTED ON BEDS VERSUS PLANTED IN FURROWS AT EXPERIMENT, GEORGIA, 1922

Four rows, 210 feet long each, were set to potato plants on beds, the method commonly practiced by farmers and gardeners in growing sweet potatoes. Four other rows, of the same length were planted at the same time, and the plants set down in the furrows. Both areas were fertilized alike and the plants kept cleanly cultivated. The yields of potatoes were:

	Bushels Potatoes Per Acre
Four rows, plants set on beds	395
Four rows, plants set in furrows	203

Reference: Georgia Agricultural Experiment Station Thirty-fifth Annual Report, page 20, 1922, Experiment, Georgia.

D. PLANTING DATES

What are the most desirable dates for setting sweet potatoes?

What is the average difference in production per acre from early and late plantings?

In what percentage of the cases do the earlier plantings have a higher total yield than the late plantings? A higher yield of No. 1's? A higher yield of No. 2's? A higher yield of Jumbo's?

I.

TIME OF PLANTING EXPERIMENT WITH SWEET POTATOES AT FLORENCE, S. C.

These studies were conducted at the Pee Dee Experiment Station under soil, climate, and other conditions that are fairly representative of those over a large part of the Middle, South Atlantic, and Gulf States where sweet potatoes are grown. The Porto Rico variety, the most important in the South, was used. It is possible that other varieties might give different results.

Seed stock of a strain grown at the Pee Dee Experiment Station for several years was used. The land was plowed and prepared in the usual way. Rows were marked out 4 feet apart and a 3-8-9 fertilizer applied in the rows at the rate of 500 pounds per acre. The fertilizer was cultivated in thoroughly, and low ridges were thrown up about 1 week before planting.

Each plot consisted of four adjacent 90-foot rows, and quadruplicate plots were set for each spacing and for each date of planting. Special care was taken to replace all weak or dead plants, and the resultant stand was practically perfect.

Each crop received the usual cultural care throughout the season and was harvested soon after cutting and removing the vines and then plowing the roots out with a sweet potato harvester. They were freed from the soil by hand and graded into oversized sweet potatoes or Jumbos, U. S. No. 1, and U. S. No. 2, and then weighed.

In order to insure that all plots in these studies were set with plants as nearly alike as possible, seed stock was bedded separately for each planting

1 month before the date the plants were to be set in the field. Therefore, first-crop sprouts of similar age and origin were available for all planting dates. On account of varying temperatures and moisture conditions in the plant beds there was some difference in the size of the plants from the various beddings. This was particularly true of the latter beddings which yielded larger plants on account of higher temperatures. An effort was made, however, to select plants of uniform size for all plantings.

Plantings were made on May 15, May 30, June 15, June 30, and July 15 in 1930, 1931, and 1932. Quadruplicate plots of each planting date were separated from each other by four similar plots, or by a distance of about 65 feet.

TABLE 19—EFFECT OF TIME OF PLANTING UPON YIELDS OF DIFFERENT GRADES OF SWEET POTATOES AT FLORENCE, SOUTH CAROLINA, 1929-31

Year and Planting Date	Jumbo	Yield in Bushels Per Acre		Total
		U. S. No. 1	U. S. No. 2	
1930				
May 15	149	285	92	526
May 30	31	227	92	350
June 15	25	265	73	363
June 30	9	131	69	209
July 15		86	71	157
1931				
May 15	19	168	58	245
May 30	17	148	79	244
June 15	11	40	29	80
June 30	2	36	28	66
July 15		35	28	63
1932				
May 15	103	161	37	301
May 30	76	157	49	282
June 15	67	114	51	232
June 30	28	76	40	144
July 15	19	68	49	136
3 Year Average				
May 15	90	204	62	356
May 30	41	177	73	291
June 15	34	140	51	225
June 30	13	81	46	140
July 15	6	63	49	118

TABLE 19-A—PERCENTAGE* OF JUMBO, U. S. No. 1, and U. S. No. 2 SWEET POTATOES IN RELATION TO TOTAL YIELD FOR 1930, 1931 AND 1932

	1930			1931			1932			3 Year Average		
	Jum- bo	U. S. No. 1	U. S. No. 2	Jum- bo	U. S. No. 1	U. S. No. 2	Jum- bo	U. S. No. 1	U. S. No. 2	Jum- bo	U. S. No. 1	U. S. No. 2
May 15	28.0	54.0	18.0	8.1	72.9	19.0	34.3	55.4	12.3	23.5	60.8	16.4
May 30	8.8	64.7	26.5	7.1	60.6	32.2	26.9	55.7	17.4	14.3	60.3	25.4
June 15	6.9	73.1	20.0	14.3	49.2	36.5	28.7	49.2	22.1	16.6	57.2	26.2
June 30	4.3	62.6	33.1	7.1	53.5	39.4	19.6	52.7	27.7	10.3	56.3	33.4
July 15	.0	50.0	50.0	.0	65.2	34.8	14.2	52.3	33.5		55.8	39.4

*Percentage by weight.

Reference: U. S. Department of Agriculture Circular 327, pages 2, 3, 6, and 9, tables 4 and 8, November 1934, "Influence of Spacing and Time of Planting on the Yield and Size of the Porto Rico Sweet Potato", Washington, D. C.

II.

WHAT IS THE BEST DATE TO TRANSPLANT SWEET POTATOES?

The Georgia Agricultural Experiment Station located at Experiment,

Georgia conducted tests on the time of setting sweet potato plants to the field during 1910, 1911 and 1913.

The plats were two rows 209 feet long. The Pumpkin Yam variety was used.

Results of this experiment are given in Table 20.

TABLE 20—EFFECTS OF DATE OF PLANTING ON YIELDS OF SWEET POTATOES, EXPERIMENT, GEORGIA

Date Planted	Marketable	Pounds Potatoes	
		Small	Total
1910			
April 23	141	71	212
April 31	160	67	227
May 12	250	55	305
May 24	182	56	238
June 1	259	73	332
June 11	412	63	475
June 21	275	43	318
July 1	314	54	368
July 15	44	14	58
July 30	0	4	4
1911			
May 6	410	238	648
May 16	506	271	777
May 26	241	136	377
June 5	258	148	406
June 15	203	96	299
June 25	185	97	282
July 5	109	88	197
July 15	146	85	231
July 25	23	12	35
1913			
May 20	346	88	434
May 30	272	86	358
June 6	212	70	282
June 19	244	62	306
June 28	0	178	178
July 7	0	106	106
July 17	0	34	34
July 28	0	14	14
August 9	0	0	0

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Reference: Agricultural Education Volume 10, No. 9, pages 133 and 134, table 5, May 1934, Clemson College, South Carolina.

III.

TABLE 21—THE EFFECTS OF DIFFERENT DATES OF PLANTING ON TOTAL YIELDS OF SWEET POTATOES, TIFTON, GA.

Dates of Planting	Total Yields in Bushels Per Acre						Av. 6 Yrs.
	1922	1923	1924	1925	1926	1927	
April 1	367.46	282.38	421.28	145.32	282.48	262.19	294
April 15	263.62	268.77	390.07	171.17	278.81	178.73	259
May 1	210.92	244.04	264.95	108.90	250.87	166.42	208
May 15	196.90	222.09	246.94	129.64	238.21	164.99	200
June 1	140.25	180.30	194.25	102.22	136.66	97.53	142
June 15	121.55	94.35	176.60	94.60	105.60	132.53	121
July 1	45.10	44.19	171.65	67.65	58.97	53.19	73
July 15	55.13	38.42	108.90	42.60	67.92	42.68	59
August 1*	13.33	26.17	88.80	8.32		12.69	30

*Five year average.

TABLE 22—THE EFFECTS OF DIFFERENT DATES OF PLANTING ON YIELDS OF No. 1's, TIFTON, GA.

Dates of Planting	Yields of No. 1's in Bushels Per Acre						Av. 6 Yrs.
	1922	1923	1924	1925	1926	1927	
April 1	119.76	115.90	190.05	117.70	157.09	215.32	153
April 15	118.65	105.45	191.40	124.02	160.18	102.30	134
May 1	115.36	98.37	165.55	78.10	141.35	106.83	118
May 15	116.87	83.66	173.52	90.20	133.10	125.40	120
June 1	66.13	78.71	139.83	49.63	79.75	57.47	79
June 15	47.02	36.69	124.30	47.85	52.80	89.23	66
July 1	16.50	19.75	102.57	30.80	22.27	23.23	36
July 15	17.33	7.70	55.00	17.45	16.77	12.87	21
August 1*	5.03	0.00	23.50	1.87		1.71	6

*Five year average.

TABLE 23—THE EFFECTS OF DIFFERENT DATES OF PLANTING ON YIELDS OF No. 2's, TIFTON, GA.

Dates of Planting	Yields of No. 2's in Bushels Per Acre						Av. 6 Yrs.
	1922	1923	1924	1925	1926	1927	
April 1	35.39	100.29	20.28	13.20	77.00	20.90	45
April 15	69.15	90.47	27.50	34.10	58.57	37.40	53
May 1	37.95	94.39	35.88	19.25	76.58	26.04	48
May 15	56.70	80.30	30.25	16.77	65.51	21.72	45
June 1	58.36	48.25	32.17	24.20	33.68	17.60	36
June 15	28.87	32.17	31.07	24.75	23.65	22.00	27
July 1	20.20	14.64	38.08	21.45	23.23	11.68	22
July 15	25.43	7.70	28.60	13.60	12.65	8.17	16
August 1*	3.35	14.43	32.17	3.60		5.63	12

*Five year average.

Reference: Agricultural Education Vol. IV., No. 13, August 1928, page 139, tables 4a, 4b, 4c, Clemson College, South Carolina.

IV.

TABLE 24—THE EFFECTS OF PLANTING DATES ON EARLY PRODUCTION OF SWEET POTATOES AT TIFTON, GEORGIA

Average Yields for 5 Years 1927 to 1931, Inclusive

Fertilizer—800 pounds per acre analyzing 3.3% Nitrogen, 8% Phosphoric Acid and 4% Potash.

Average Date Harvested—July 29th.

		Yields in Bushels Per Acre				No. Growing Days
Date Planted	No. 1's	No. 2's	Strings	Jumbos	Total	
Porto Rico :						
March 15th	114.03	15.83	14.62	6.29	150.77	137
April 1st	89.70	13.41	14.79	9.03	126.93	120
April 15th	35.39	8.54	17.31	.30	61.54	105
Big Stem Jersey						
March 15th	83.87	18.73	21.08	.43	124.11	137
April 1st	50.34	17.95	27.87		96.16	120
April 15th	16.75	9.19	23.31		49.25	105

V.

TABLE 25—THE EFFECT OF PLANTING DATES ON LATE MATURITY AT TIFTON, GEORGIA

Average Yields (Porto Rico), 6 Years 1922 to 1927, Inclusive

Fertilizer—500 pounds per acre analyzing 1.6% Nitrogen, 9% Phosphoric Acid and 3% Potash.

Average Date Harvested—November 1st.

Date Planted	Yields in Bushels Per Acre					Total	No. Grow- ing Days
	No. 1's	No. 2's	Strings	Jumbos	Rot		
April 1st	152.64	44.51	25.43	45.73	23.89	292.20	218
April 15th	133.67	52.87	25.07	36.83	10.27	258.71	203
May 1st	117.60	48.35	24.66	15.23	1.86	207.69	188
May 15th	120.46	45.21	22.60	10.21	1.41	199.89	173
June 1st	78.59	35.71	22.77	4.55	.25	141.87	157
June 15th	66.31	27.08	20.67	6.81		120.87	142
July 1st	35.86	21.55	15.59	.47		73.47	127
July 15th	21.17	16.02	22.08			59.27	112
August 1st*	6.42	11.83	11.60			29.85	97

*Five year average.

Reference: Georgia Coastal Plain Experiment Station, Bulletin No. 17, Pages 38 and 39, Tables XXI. and XXII., February, 1932. "Sweet Potato Culture in the Coastal Plain of Georgia". Tifton, Georgia.

E. SPACING SWEET POTATOES

What is the most productive distance apart for sweet potato rows?

How far apart should the plants be set in the row?

Which is more conducive to total yield, close or wide spacing?

To the yield of No. 1 potatoes? To the yield of No. 2 potatoes? To the yield of Jumbos?

I.**DISTANCE APART AT STATE COLLEGE, MISSISSIPPI**

A test to determine the proper distance in rows to plant sweet potatoes was conducted by the Department of Horticulture at Mississippi A. & M. College for a period of five years, 1925 to 1929, inclusive.

All plots received the same culture.

Results are given in Table 26.

TABLE 26—EFFECTS OF DISTANCE IN ROWS ON YIELDS OF SWEET POTATOES, STATE COLLEGE, MISS., 5 YEAR AVERAGE

Distance in Drill	Bushels Per Acre
10 inches	240
15 inches	200
20 inches	192
25 inches	168
30 inches	175
35 inches	160

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Reference: Agricultural Education Volume 10, No. 9, pages 136 and 137, table 10, May 1934, Clemson College, South Carolina.

II.

TABLE 27—SPACING OF SWEET POTATO PLANTS AT HOLLY SPRINGS, MISSISSIPPI, 3 YEARS

Space Used	Average Yield in Bushels			
	1923	1925	1926	Three Year Av'ge.
7 inches in drill	206	187	177	190
14 inches in drill	171	167	151	163
21 inches in drill	154	151	147	151

Soil type—Lintonia silt loam (terrace or second bottom land).

Variety—1925, Nancy Hall; 1926, Porto Rico.

Size of plots—1923, 1/38 acre, 1925, 1/20 acre; 1926, 1/23 acre.

Fertilizer used—1923, 300 pounds superphosphate, 150 pounds nitrate of soda and 100 pounds kainit.

Planting date—1923, June 25; 1926, June 10.

Harvesting date—1923, October 23.

Reference: Mississippi Agricultural Experiment Station Bulletin 239, page 22, table 18, December 1926, "Report Holly Springs Branch Experiment Station 1926", State College, Mississippi.

III.

SPACING TEST ON SWEET POTATOES AT POPLARVILLE, MISS.

The middles between the fertilizer plats of sweet potatoes were set to double rows for this spacing test. Two rows, one foot apart were set on each bed with the plants 15 inches apart in the row. This gave twice as many plants to the bed as in the fertilizer rows. Also, duplicated plats were set to plants, spaced 7½ inches apart in the row, thus giving twice as many plants per row as in the fertilizer plat rows. No fertilizer was used for these double rows, or 7½ inch spacing rows, as these were to serve as divisions for the fertilizer plats. These double rows and 7½ inch spaced rows were checked with the check plats of the fertilizer test, and the yield records were as follows:

TABLE 28—SPACING TEST WITH SWEET POTATOES AT SOUTH MISS. BRANCH EXPERIMENT STATION, POPLARVILLE, MISS.

Spacings	Yield in Bushels Per Acre							
	1921		1922		1923		Average	
	No. 1 & 2	Total	No. 1 & 2	Total	No. 1 & 2	Total	No. 1 & 2	Total
Fertilizer check plots	81	181	80	179	33	44	65	135
Double row plots	135	220	135	220	62	99	111	180
7½ in. spaced plots			81	181	70	82		

The great disadvantage to the double row system is the fact that so much more hoeing is necessary in the cultivation of the double rows than is necessary with single rows, and it is usually the case that labor for plowing is more plentiful than for hoeing.

The plats used are 1-75 of an acre in size.

Reference: Mississippi Agricultural Experiment Station Circular 57, table 3, "Sweet Potato Experiment South Mississippi Experiment Station", 1924, State College, Mississippi.

IV.

TABLE 29—SPACING TEST (DRILL), TIFTON, GEORGIA

Average Yields (Porto Rico), 6 Years 1922 to 1927, Inclusive)

Fertilizer—500 pounds per acre analyzing 1.6% Nitrogen, 9% Phosphoric Acid and 3% Potash.

Average Date Planted—May 2nd.

Average Date Harvested—November 4th.

Row Width—3½ Feet.

Average Number Growing Days—187.

Distance in Drill	Yield in Bushels Per Acre						
	No. 1's	No. 2's	Strings	Jumbos	Rot	Total	
4 Inches	126.53	68.23	54.86	6.63	.24	256.49	
8 Inches	124.66	49.10	40.10	7.38	.25	221.49	
12 Inches	122.98	42.97	35.35	9.23	.18	210.71	
16 Inches	121.43	36.52	29.18	8.33	.29	195.75	
20 Inches	118.93	36.94	21.91	9.46	.21	187.45	
24 Inches	106.56	36.08	21.32	11.86	.89	176.71	
28 Inches	98.57	40.54	22.11	17.46	1.48	180.16	

The increase in total yield from the close spacing may be attributed to the fact that a higher percentage of these potatoes were under-size and fell into the No. 2 and string grades, as will be observed from Table 29. This condition led to the suggestion that the small potatoes might be increased to marketable size by the use of additional plant food. Therefore, to meet this requirement a revised test was begun in 1928 in which the rate of application of fertilizer was based on the number of hills per acre. For example, a planting that is spaced 16 inches in the drill receives 800 pounds of fertilizer per acre, whereas a planting spaced eight inches in the drill carries double the number of plants and, therefore, receives 1600 pounds of fertilizer per acre, or an equal amount to each plant. This experiment is reported in Table 30.

V.

TABLE 30—SPACING TEST (DRILL)

Average Yields (Porto Rico), 4 Years, 1928 to 1931, Inclusive

Fertilizer—800 pounds of a 3.3-8-4 per acre, basic rate of application for plants spaced 16 inches in drill and 3½ feet in the row. Each plant in the various spacings received an equal amount of fertilizer.

Average Date Planted—May 5th.

Average Date Harvested—October 30th.

Average Number of Growing Days—179.

Distance in Drill	No. plants Lbs. fert.		Yield in Bushels Per Acre					
	per A.	per A.	No. 1's	No. 2's	Strings	Jumbos	Rot	Total
4 Inches	37428	3200	153.35	33.03	25.78	4.95	3.25	220.36
8 Inches	18714	1600	124.43	31.88	23.28	2.91	.64	183.14
12 Inches	12478	1066	93.35	22.48	27.89	1.20	.61	145.53
16 Inches	9357	800	64.03	16.83	26.13	2.12		109.11
20 Inches	7485	640	63.22	16.90	23.15	1.75	.36	105.38
24 Inches	6238	533	54.56	17.06	20.89	1.26	1.23	95.00
28 Inches	5347	457	41.41	11.15	16.80	.57	.51	70.44

Reference: Georgia Coastal Plain Experiment Station, Bulletin No. 17, Tables XVI., and XVII., Pages 33 and 34, February, 1932. "Sweet Potato Culture in the Coastal Plain of Georgia". Tifton, Georgia.

VI.

TABLE 31—SWEET POTATO SPACING TEST (ROW WIDTHS)
AT TIFTON, GEORGIA

Average Yields (Porto Rico), 7 Years, 1925 to 1931, Inclusive

Fertilizer—800 pounds of a 3.3-8-4 per acre, basic rate of application for plantings spaced 16 inches in the drill and 3½ feet in the row.

Amount of Fertilizer Per Plant—.085 Pound.

Average Date Planted—May 7th.

Average Date Harvested—October 29th.

Average Number Growing Days—176.

Plants spaced 16 inches in drill.

Row Width	Lbs. 3.3-8-4		Yield in Bushels Per Acre					
	No. Plants	Fert.	No. 1's	No. 2's	Strings	Jumbos	Rot	Total
2 Feet	16339	1389	124.08	26.01	26.11	1.47		177.67
3 Feet	10890	926	109.66	24.30	23.72	1.14	1.26	160.08
4 Feet	8169	694	87.76	28.60	17.81	4.04		138.21
5 Feet	6540	556	73.02	16.78	12.88	3.97		106.65

A study was begun in 1925 with spacings in row widths to supplement the work with spacings in the drill. In this test all plants are spaced 16 inches in the drill, while the rows vary from two to five feet.

Reference: Georgia Coastal Plain Experiment Station, Bulletin No. 17, Pages 35 and 36, Table XIX., February, 1932. "Sweet Potato Culture in the Coastal Plain of Georgia". Tifton, Georgia.

VII. SWEET POTATO SPACING EXPERIMENT AT STATE COLLEGE, NEW MEXICO, 1934

A spacing experiment with sweet potatoes to determine the possibility of increasing the yield, particularly with the Porto Rico, by closer plantings, was conducted in 1934. A small planting of Nancy Hall was made using the standard planting distances, for comparison with the other variety. Since the Porto Rico sets a light crop of tubers, that apparently accounts for their smaller production. It was thought that closer plantings would result in a larger number of potatoes and increase the yields. The rows were 4 feet apart.

The yields recorded in Table 32 are the average of the combined yields of each similarly treated series of plots.

**TABLE 32—YIELDS OF SWEET POTATOES OBTAINED WITH
DIFFERENT RATES OF PLANTING, 1934**

Variety	Plants to the Place	Distance Apart in The Row* In.	Bushels Per Acre by Grade		Total Potatoes
			No. 1 Potatoes	No. 2 Potatoes	
Porto Rico	1	15	203	94	302
Porto Rico	2	15	225	122	347
Porto Rico	3	15	207	88	295
Porto Rico	1	12	224	95	319
Porto Rico	2	12	304	108	412
Porto Rico	3	12	234	134	368
Porto Rico	1	4	243	96	339
Porto Rico	1	5	248	116	364
Porto Rico	1	6	226	102	328
Porto Rico	1	7½	329	89	418
Nancy Hall	1	15	251	93	344

*All the rows were 4 feet apart.

Reference: New Mexico Agricultural Experiment Station Forty-Sixth Annual Report, pages 45 and 46, table 3, December, 1935, State College, New Mexico.

VIII. SPACING TESTS WITH SWEET POTATOES AT FLORENCE, SOUTH CAROLINA

The seed stock for the spacing studies were bedded about April 15, and plants were set in the field about June 1 each year that the work was in progress, namely, 1929, 1930, and 1931. The spacing distances used were 6, 9, 12, and 15 inches in the row. Quadruplicate plots of each planting distance were separated from each other by three plots of similar size, or by a distance of about 52 feet.

TABLE 33—EFFECT OF SPACING UPON YIELD OF DIFFERENT GRADES OF PORTO RICO SWEET POTATOES AT FLORENCE, S. C., 1929-1931

Year and Spacing		Yields in Bushels Per Acre			Total
		Jumbo	U. S. No. 1	U. S. No. 2	
1929					
6 inches	.....	12	186	57	255
9 inches	.....	18	172	37	277
12 inches	.....	19	173	29	221
15 inches	.....	29	209	35	273
1930					
6 inches	.....	7	141	56	204
9 inches	.....	13	134	55	202
12 inches	.....	15	142	59	216
15 inches	.....	20	130	50	200
1931					
6 inches	.....	27	130	50	207
9 inches	.....	23	103	45	171
12 inches	.....	34	105	25	164
15 inches	.....	32	109	32	173
3 Yr. Average					
6 inches	.....	15	152	54	221
9 inches	.....	18	136	46	200
12 inches	.....	23	140	38	201
15 inches	.....	27	149	39	215

TABLE 34—PERCENTAGE* OF JUMBO, U. S. No. 1, and U. S. No. 2 PORTO RICO SWEET POTATOES IN RELATION TO TOTAL YIELD FOR 1929-1931, FLORENCE, SOUTH CAROLINA

Spacing	1930			1931			1932			3 Yr. Average		
	Jum- bo	U. S. No. 1	U. S. No. 2	Jum- bo	U. S. No. 1	U. S. No. 2	Jum- bo	U. S. No. 1	U. S. No. 2	Jum- bo	U. S. No. 1	U. S. No. 2
6 inches	4.8	72.9	22.3	3.7	68.9	27.5	13.0	62.7	24.1	7.2	68.2	24.6
9 inches	7.9	75.9	16.1	6.2	66.4	27.3	13.4	60.2	26.4	9.2	67.5	23.2
12 inches	8.6	78.2	13.0	7.2	65.3	27.4	20.8	63.8	15.3	12.2	69.1	18.6
15 inches	10.7	76.3	12.7	10.2	64.4	24.8	18.4	63.1	18.4	13.1	68.0	18.6

*By weight.

These studies were conducted at the Pee Dee Experiment Station under soil, climatic, and other conditions that are fairly representative of those over a large part of the Middle, South Atlantic, and Gulf States where sweet potatoes are grown. The Porto Rico variety, the most important in the South, was used. It is possible that other varieties might give different results.

Seed stock of a strain grown at the Pee Dee Experiment Station for several years was used. The land was plowed and prepared in the usual way. Rows were marked out 4 feet apart and a 3-8-9 fertilizer applied in the rows at the rate of 500 pounds per acre. The fertilizer was cultivated in thoroughly, and low ridges were thrown up about 1 week before planting.

Each plot consisted of four adjacent 90-foot rows, and quadruplicate plots were set for each spacing and for each date of planting. Special care was taken to replace all weak or dead plants, and the resultant stand was practically perfect.

Each crop received the usual cultural care throughout the season and was harvested soon after cutting and removing the vines and then plowing the roots out with a sweet potato harvester. They were freed from the soil by hand and graded into oversized sweet potatoes or jumbos, U. S. No. 1, and U. S. No. 2, and then weighed.

Reference: U. S. Department of Agriculture Circular 327, pages 2, 3, and 5, tables 1 and 3, "Influence of Spacing and Time of Planting on the Yield and Size of the Porto Rico Sweet Potato", Washington, D. C.

F. USE OF SWEET POTATO VINES AS PLANTS

To what extent is the production of sweet potatoes reduced by cutting vines? How does the reduction in yield compare in value with the sweet potatoes produced from vines?

How does the total production from vines compare with that from draws? Is it economical to cut vines for setting?

I.

TABLE 35—EFFECTS OF CUTTING VINES ON YIELDS OF SWEET POTATOES, STATE COLLEGE, MISS., SIX YEAR AVERAGE, 1924-29

Per cent Cut	Bushels Per Acre
100	195
75	243
50	258
25	265
None	304

Miss. Bul. 279

The Department of Horticulture at the Mississippi A. & M. College conducted an experiment to determine the effect of cutting vines on the yield of sweet potatoes. This experiment was begun in 1924 and continued through 1929.

The cutting was done as near July 1 as possible. The vines, at the time of cutting were usually from three to five feet long. The potatoes were dug in October at the regular season.

Reference: Agricultural Education Volume 10, No. 9, page 137, table 11, May, 1934, Clemson College, South Carolina.

II.

PLANTS FROM TIP ENDS VERSUS STEM ENDS AT TIFTON, GEORGIA

In the spring of 1924 Porto Rico seed potatoes were cut into halves, viz., the tip and stem ends. Each part of the potato was planted separately and each successive year the tip and stem ends, respectively, of the potatoes resulting from the two original parts have been used as a source of plants for the succeeding crops.

TABLE 36—THE INFLUENCE OF TIP AND STEM ENDS OF SWEET POTATOES ON PRODUCTIVITY AT TIFTON, GEORGIA

Average Yields (Porto Rico), 5 Years, 1924 to 1928, Inclusive

Fertilizer—500 pounds per acre analyzing 9% Phosphoric Acid, 1.66% Nitrogen and 3% Potash.

Average Date Planted—May 10th.

Average Date Harvested—November 5th.

Average Number Growing Days—180.

Part of Potato	Yield in Bushels Per Acre					Total
	No. 1's	No. 2's	Strings	Jumbos	Rot	
Tip End	99.62	23.20	22.04	4.27	.88	150.01
Stem End	96.53	19.35	17.28	5.84	10.92	149.92

Reference: Georgia Coastal Plain Experiment Station, Bulletin No. 17, Pages 15 and 16, Table VI., February, 1932. "Sweet Potato Culture in the Coastal Plain of Georgia". Tifton, Georgia.

III.

TABLE 37—INFLUENCE OF VINE PARTS OF SWEET POTATOES
YIELDS AT TIFTON, GEORGIAAverage Yields (Porto Rico) for 7 Years, 1922, 1923, 1926,
1927, 1928, 1930 and 1931Fertilizer—800 pounds per acre analyzing 8% Phosphoric Acid, 3.3%
Nitrogen and 4% Potash.

Average Date Planted—June 2nd.

Average Date Harvested—October 29th.

Average Number Growing Days—150.

Part of Vine	No. 1's	No. 2's	Yield in Bushels Per Acre		Rot	Total
			Strings	Jumbos		
Tip (4th Part).....	43.27	17.10	23.46	.04		83.87
Third Part	38.56	17.94	20.59	.05	.02	77.16
Second Part	39.97	16.20	19.60	.04		75.81
Base (1st Part)....	28.79	16.29	17.12	.05		62.25

In order to determine whether or not the more fibrous, woody part of the vine near the base, or the tender, succulent part near the tip is better suited for vine cuttings, a test was begun in 1922 and was continued over a seven-year period. The tips are also more desirable when taking vines for the purpose of growing seed potatoes, because there is less likelihood of carrying disease from the old plant in cuttings from the tip than from the base.

Reference: Georgia Coastal Plain Experiment Station, Bulletin No. 17, Page 15, Table V., February, 1932. "Sweet Potato Culture in the Coastal Plain of Georgia". Tifton, Georgia.

IV.

TABLE 38—EFFECT OF VINE PRUNING ON SWEET POTATO YIELDS
AT TIFTON, GEORGIA

Average Yields (Porto Rico), 6 Years, 1926 to 1931, Inclusive

Fertilizer—800 pounds per acre analyzing 8% Phosphoric Acid, 3.3%
Nitrogen and 4% Potash.

Average Date Planted—May 14th.

Average Date Harvested—October 31st.

Average Number Growing Days—171.

Method	No. 1's	No. 2's	Yield in Bushels Per Acre		Rot	Total
			Strings	Jumbos		
Unpruned	88.79	23.02	21.85	13.09	2.07	148.82
¼ Pruned	85.91	23.20	23.30	1.15	1.10	134.66
½ Pruned	80.11	26.74	19.35	1.17	.07	127.44
¾ Pruned	71.97	24.12	19.78	.78	.41	117.06
All Pruned	62.29	14.36	19.35	1.11	.29	97.40

Reference: Georgia Coastal Plain Experiment Station, Bulletin No. 17, Page 41, Table XXIV., February, 1932. "Sweet Potato Culture in the Coastal Plain of Georgia". Tifton, Georgia.

V.

EFFECTS OF CUTTING OFF VINES ON YIELD AT EXPERIMENT,
GEORGIA

It is the practice in a number of localities to pen some pigs near the potato patch and feed them from time to time on cuttings from the vines as soon as the vines cover the ground.

To determine the effects of severe cutting of vines on the yield of the

sweet potato, a test was made during the season of 1912. Six rows, 209 feet long, were well fertilized and set to the Enormous variety of sweet potato early in May. These potatoes were given the same culture usually given in growing potatoes.

By June 14th the vines had completely covered the soil. Those of rows 1 and 2, and 5 and 6 were cut back to one foot in length and removed from the field. A few weeks later, these had grown out so that the entire soil was again covered so that one could hardly tell that any vines had been removed. On October 24th the potatoes were harvested with the following results:

Rows 1 and 2 (vines cut).....	680 pounds
Rows 3 and 4 (Not cut).....	1062 pounds
Rows 5 and 6 (vines cut).....	620 pounds

Reference: Georgia Agricultural Experiment Station, Bulletin 107, page 88, March, 1914, "Sweet Potatoes, Culture, Storing and Studies in Fertilizing", Experiment, Georgia.

VI.

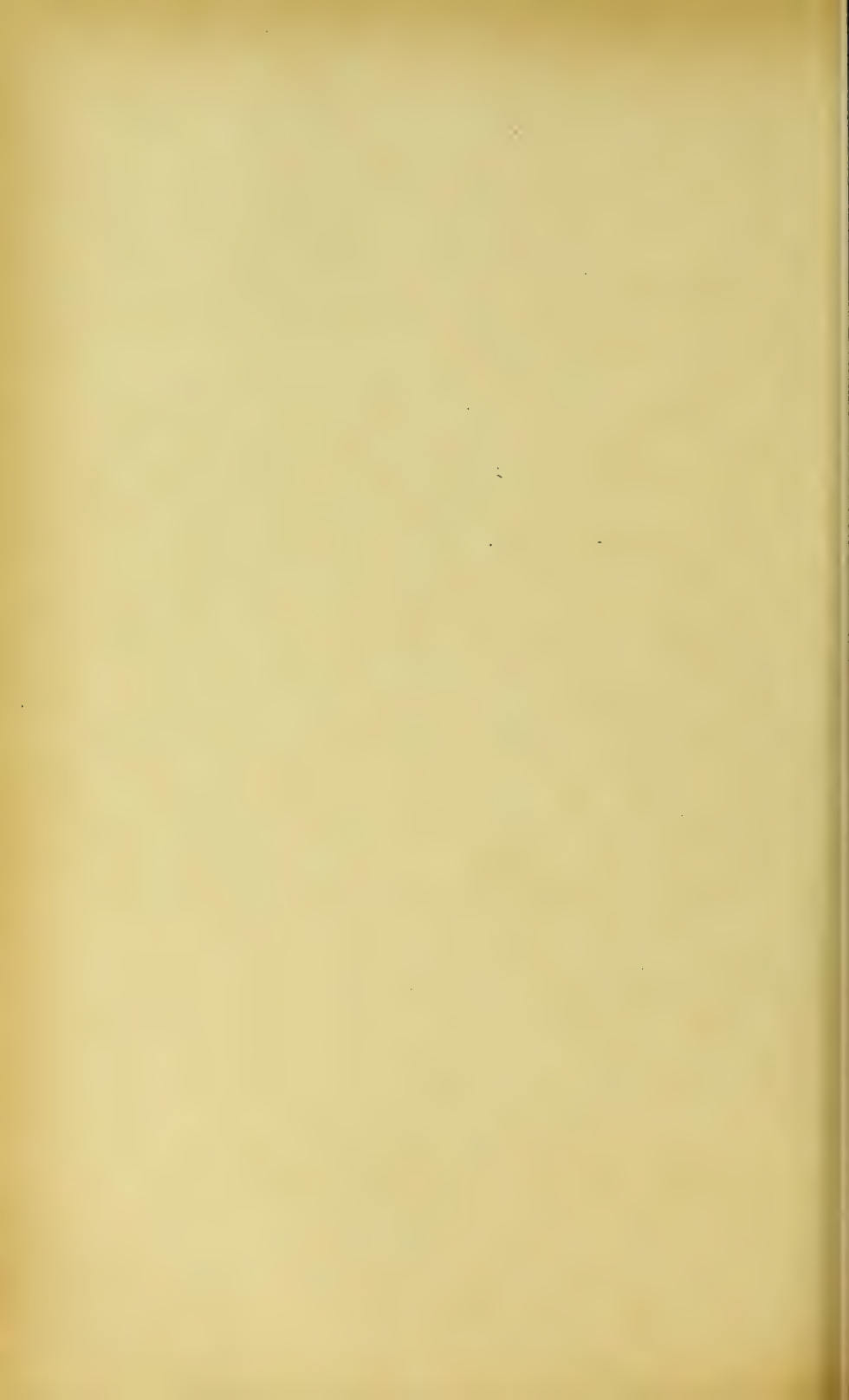
THE COMPARATIVE VALUE OF PLANTS AND VINES FOR LATE PLANTING AT EXPERIMENT, GEORGIA

On July 28, 1913, two plats containing one-fifty-second of an acre each were set, one to sweet potato plants and the other to pieces of sweet potato vines about fourteen inches long. The plants were set in the usual way. The pieces of vine were bent double and the middle poked into the soil, leaving from one to two inches of the ends above the soil.

The vines set roots and started growth only a few days later than the plants. The same number of hills were grown in each plat and the same kind of fertilizer and culture were given. The crop was harvested October 15th with the following results:

Plants yielded.....	7 pounds of potatoes
Vines yielded.....	36 pounds of potatoes

Reference: Georgia Agricultural Experiment Station Bulletin 107, page 87, March, 1914, "Sweet Potatoes, Culture, Storing and Studies in Fertilizing", Experiment, Georgia.



SAGRAIN
In The
YAZOO-MISSISSIPPI DELTA
Delta Experiment Station

Stoneville, Mississippi

By
Roy Kuykendall



Second and third year strains in the early sagrain breeding work.

MISSISSIPPI AGRICULTURAL EXPERIMENT STATIONS

State College, Mississippi

J. R. RICKS, Director

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SAGRAIN IN THE YAZOO-MISSISSIPPI DELTA

Roy Kuykendall *

INTRODUCTION

Sagrain is one of the major feed crops in the Yazoo-Mississippi Delta. It is adapted to most all soil types throughout the Delta area. It is similar to sorghum in that it is in the sorghum family, and thrives under the same adverse conditions. It produces more grain than ordinary sorghum and is a safer feed crop than corn on the soils that are usually used for corn in the Yazoo-Mississippi Delta. It responds very readily to good soils, fertilizers and good cultivation, but will withstand much more neglect and adverse conditions than the other common feed crops of this area.

HISTORY AND DESCRIPTION

In 1917 Mr. W. T. Allen, Clarksdale, Mississippi, planted a field of sweet sorghum to cut and feed green to his livestock. In this field there was a mixture of regular sorghum and some low growing, heavy grain-producing stalks,

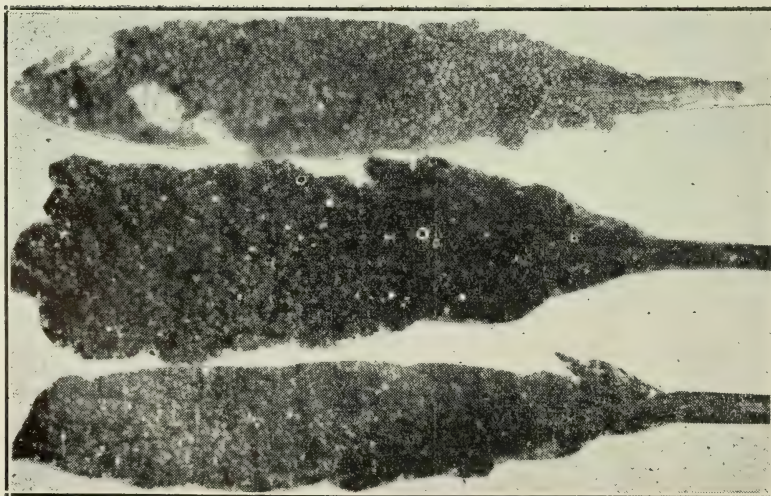


Long and short type plants in the early sagrain breeding work.

*Acknowledgements: The Author wishes to express his appreciation to Mr. W. E. Ayres, under whose direction this work was carried out; to Mr. H. A. York, who is responsible for the present selected strain of sagrain; and to Mr. J. B. Turner who conducted the 1927 tests.



One sagrain stool showing number of heads produced when stand is poor.



Grain sorghum head types. Left, darso; center, sagrain; right, schrock.

Dr. W. J. Lacy, Lyon, Mississippi, noticed these peculiar, short stalks, investigated and found out that it was not an intended mixture of sweet sorghum and one of the kaffirs which it resembled. Both types were sweet. Dr. Lacy asked and was granted the privilege of cutting a seed supply. He selected the choicest heads and most uniform stalks over the entire field. He continued to select his seed each year in this manner.

In 1923 the Delta Station obtained from Dr. Lacy some selected heads from this low growing, heavy grain producing sorghum. These heads were planted in a plant to row test in 1924. There was considerable variation in plant type and grain yield, but all strains had sweet stalks which were rather stocky and the grain yield extremely high. This seed selecting and increasing was continued until the present strain, called sagrain, was developed.

It is the opinion of some that sagrain and schrock are identical. They are similar in that both, presumably, are hybrids of some sweet sorghum and a grain sorghum. It is possible to select many different plant types from either. Sagrain could be a new hybrid or a new strain of schrock resulting from several years of careful selection. It was named "sagrain" (to indicate saccharine, grain sorghum) because of its evident kinship to both grain and saccharine sorghum.



A high grain yielding field of sagrain.

TESTS AND METHODS

Since 1923, various types of experiments with sagrain have been conducted at this station. These investigations have consisted of the following tests:

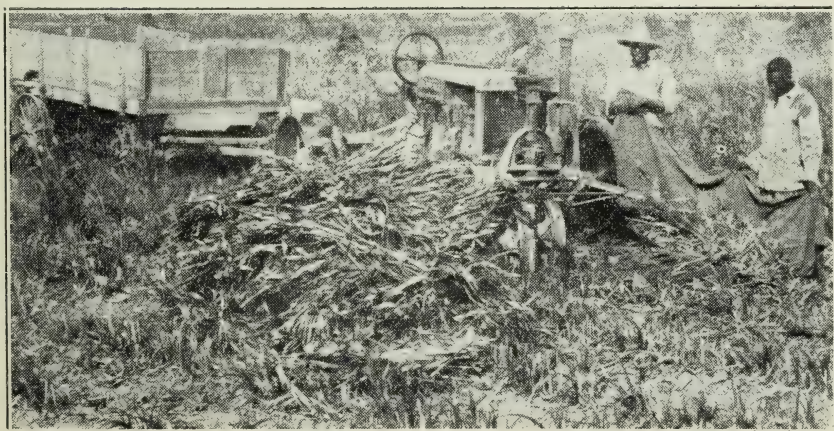
1. Dates of seeding.
2. Spacing.
 - a. Sagrain alone.
 - b. Sagrain and soybeans.
3. Fertility.
4. Direct applications of commercial fertilizers.
 - a. Sources of commercial nitrogen.
 - b. Rates of applying ammonium sulphate.
 - c. Dates of applying ammonium sulphate.
- B. Indirect applications of commercial fertilizers.
 - a. Residual effect of "sources of nitrogen" applied to a preceding crop of oats.
 - b. Residual effect of "rates of applying sodium nitrate" applied to a preceding crop of oats.
 - c. Residual effect of "dates of applying sodium nitrate" applied to a preceding crop of oats.
- C. Residual effect of sagrain, corn and varieties of soybeans on the following crop of cotton.
4. Sagrain as a pasture crop.
5. Sagrain curing and winter storing in the open.



Harvesting sagrain with a corn binder.



Shocking sagrain on a Yazoo-Mississippi Delta plantation.



Removing sagrain heads with a tractor cut off saw in the fertilizer tests.

All plots consisted of six 1/108 of an acre rows and the four center rows were harvested with a corn binder from which to compute per acre yields. In most cases the sagrain was cut, bundled, shocked and cured in the field. The heads from each treatment were thrashed and the grain weighed separately. The cured stalks were weighed in the field.

In a few cases where the grain failed to mature the sagrain was cut, bundled and weighed green and representative samples taken to obtain the percentage dry weight then the total per acre dry weight computed from the dry weight percentage of the sample.

All tests were planted with a two row planter.

There were seven replications of each date of seeding. The order of the date of seeding was reversed each year. Soybeans were interplanted in the row with the sagrain when the sagrain was planted. This test was conducted on a Sharkey sandy loam soil.

The sagrain alone and sagrain and soybeans spacing tests were identical except the latter had soybeans planted in alternate hills. The sagrain was planted with a two row planter in hills 13 inches apart and thinned according to the plan. The soybeans were allowed to stand as they came up.

In 1928 and 1929 ammonium sulphate was applied to all plots in the spacing tests at the rate of 200 pounds per acre. In 1930 the rate was changed to 150 pounds per acre. There were two replications in each test. Both tests were conducted on a Sharkey clay loam soil.

The fertility tests were divided into two classes, namely: Those in which the fertilizers were applied directly to the sagrain crop and those in which the fertilizers were applied to a preceding crop of oats.

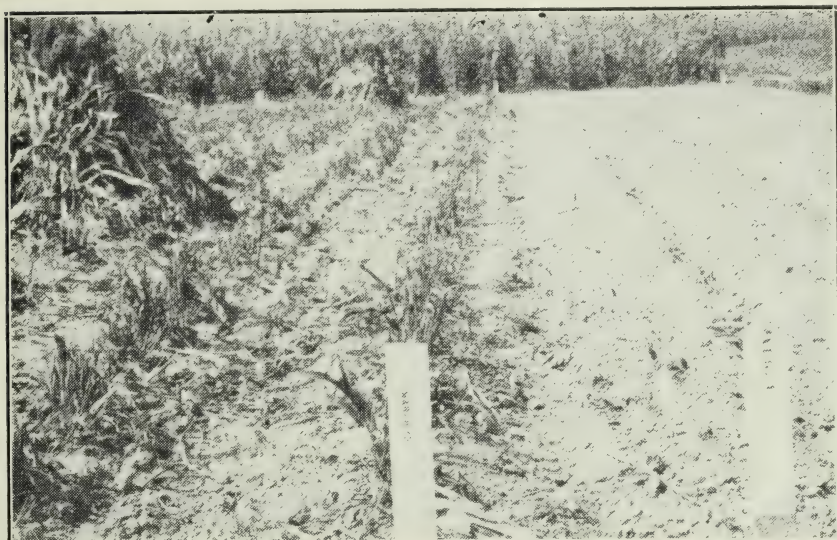
In the direct applications tests the fertilizers were weighed for each row separately and applied by hand. Each fertilizer was applied before planting except in the "dates of application" where applications were made as indicated. These tests were conducted on a Sharkey clay loam soil. In the tests where the fertilizers were applied to the preceding crop of oats the correct amount of fertilizer for each plot, 1/20 of an acre, was weighed and applied on the oats in the spring except where otherwise stated. Thirty pounds of nitrogen per acre were used everywhere except in the rates of application or where otherwise stated. These tests were conducted on a Sharkey loam soil. All treatments were replicated from three to five times.

The sagrain, corn and varieties of soybeans were planted at the same time and fertilized alike. The per acre yield was calculated on the total grain, stover and soybeans. The test was rotated with sagrain, corn and varieties of soybeans one year and cotton the next. The test was so arranged that both cotton and the other crops were grown every year. The cotton was not otherwise fertilized. These tests were conducted on a Sharkey clay loam soil.

EXPERIMENTAL RESULTS

DATES OF SEEDING

The object of this test was to determine just how late sagrain could be planted and produce a crop, and the best average date of seeding.



Left—Sagrain planted March 15; cut and shocked August 15.

Right—Sagrain planted August 1 and not up August 15 because of the lack of moisture.



Sagrain planted March 15 and cut August 15. Second growth matured heads by November 1, the date of the photograph.

TABLE I—Dates of Seeding Sagrain*

Seeding Date	1929	1930	1931	1932	1933	Av. yield 1929-33
Yields—bushels of grain per acre						
March 15 -----	22.9	4.0	16.2	38.1	21.1	20.5
April 1 -----	24.5	9.3	32.1	30.1	4.8	20.2
April 15 -----	24.7	8.9	24.5	24.5	29.2	22.4
May 1 -----	17.2	4.1	20.6	16.8	9.5	13.6
May 15 -----	---	6.7	19.3	---	---	5.2
June 1 -----	---	12.8	---	---	---	---
June 15 -----	---	18.3	---	---	---	---
July 1 -----	---	14.3	---	Failed to mature grain		---
July 15 -----	---	1.9	---	---	---	---
August 1 -----	---	.2	---	---	---	---

Yields—pounds of heads and stover per acre

March 15 -----	8173	4701	8451	5666	4672	6333
April 1 -----	8234	5610	8281	7206	4258	6718
April 15 -----	9596	6027	7296	6335	4459	6743
May 1 -----	13490	8606	7758	6322	3871	8009
May 15 -----	11333	9980	7796	4688	6937	8147
June 1 -----	8878	11773	Failed	5671	3920	6048
June 15 -----	7566	7713	to	7249	5616	5629
July 1 -----	7064	6026	mature	6340	5505	4987
July 15 -----	Failed	4193	heads	Failed	9410	2720
August 1 -----	to head	817		to head	7017	1567

* All dates of planting produced a fair growth of stalks but most of the late ones failed to mature seed and were not harvested and weighed every year.

According to the results obtained by Delta planters sagrain will produce and mature fair crops of stover and grain planted any date between March 15 and August 1, however in this test on light loam land it failed to yield mature grain three years out of five when planted later than May 1, and failed four years out of five when planted later than May 15. The results as given in Table I show that the highest grain yields were produced from plantings made April 15 while the plantings of May 1 to 15 produced the greatest yields of forage.

SPACING

As sagrain was a new crop in the Delta, information was needed as to how thick to leave the stand to produce maximum yields. Spacing tests with sagrain alone and in combination with alternate hills of soybeans were begun in 1928. The results of these tests are given in Table II and III

TABLE II—Sagrain Spacing—Sagrain Alone

Plants per hill in 13-inch spacings	1928	1929	1930	1931	1932	Averages	
						Yield	Increase
Yields—bushels of grain per acre							
5 Plants per hill ----	31.3	27.5	24.2	11.5	33.7	25.6	
2 Plants per hill ----	28.4	29.5	22.9	9.2	33.7	24.7	—0.9
3 Plants per hill ----	21.8	29.2	25.2	9.1	33.6	23.8	—1.8
4 Plants per hill ----	25.8	34.3	24.4	9.1	36.2	26.0	0.4
5 Plants per hill ----	31.3	27.5	24.2	11.5	33.7	25.6	
6 Plants per hill ----	23.4	32.8	24.3	13.6	33.7	25.6	0.0
7 Plants per hill ----	26.1	30.5	23.3	10.1	34.7	24.9	—0.7
Blocked all left ----	28.7	29.3	20.7	11.2	32.2	24.4	—1.2
5 Plants per hill ----	31.3	27.5	24.2	11.5	33.7	25.6	

Yields—pounds of heads and stover per acre

5 Plants per hill ----	7607	4914	10330	8617	8122	7918	
2 Plants per hill ----	6740	4680	8725	6118	7259	6704	—1214
3 Plants per hill ----	7357	5470	9888	7420	7501	7527	— 391
4 Plants per hill ----	7017	6265	10020	8475	7810	7917	— 1
5 Plants per hill ----	7607	4914	10330	8617	8122	7918	
6 Plants per hill ----	7801	4388	10956	8536	7802	7897	— 21
7 Plants per hill ----	6736	5645	9264	8158	8896	7740	— 178
Blocked all left ----	7947	5441	10256	8668	10416	8546	628
5 Plants per hill ----	7607	4914	10330	8617	8122	7918	



2 sagrain plants per hill; soybeans predominate.



3 sagrain plants per hill; soybeans predominate



7 sagrain plants per hill; sagrain predominates

TABLE III—Sagrain Spacing With Alternate Hills

George Washington Soybeans

Plants per hill in 26 inch spacings	1928	1929	1930	1931	1932	Averages	
						Yield	Increase
Yields—bushels of grain per acre							
5 Plants per hill ----	19.2	20.5	5.4	7.7	21.3	14.8	
2 Plants per hill ----	13.7	21.8	5.0	5.4	15.0	12.2	—2.6
3 Plants per hill ----	13.7	20.6	4.4	6.0	16.1	12.2	—2.6
4 Plants per hill ----	14.9	22.9	6.1	7.6	20.4	14.4	—0.4
5 Plants per hill ----	19.2	20.5	5.4	7.7	21.3	14.8	
6 Plants per hill ----	21.6	24.2	6.2	7.8	22.3	16.4	1.6
7 Plants per hill ----	24.4	25.1	4.4	7.2	21.0	16.4	1.6
Blocked all left ----	28.7	21.2	3.0	11.0	24.1	17.6	2.8
5 Plants per hill ----	19.2	20.5	5.4	7.7	21.3	14.8	

Yields—pounds of heads and stover per acre							
5 Plants per hill ----	7696	4037	12461	4974	5362	6906	
2 Plants per hill ----	7035	5587	11711	4364	4637	6667	—239
3 Plants per hill ----	6682	5119	12101	5098	4986	6797	—109
4 Plants per hill ----	7474	5616	13632	4771	5112	7321	415
5 Plants per hill ----	7696	4037	12461	4974	5362	6906	
6 Plants per hill ----	7357	6055	12826	5266	5150	7331	425
7 Plants per hill ----	8624	6523	12948	5208	5236	7708	802
Blocked all left ----	10220	4914	11570	5815	5098	7523	617
5 Plants per hill ----	7696	4037	12461	4974	5362	6906	

The 4 to 6 plants per hill spacings produced the highest average yields of grain and the 5 or more plants per hill produced the highest stover yields in the sagrain alone spacing test. Six or more plants per hill produced the highest average yields of grain and stover in the sagrain and soybeans spacing test. See Tables II and III.

Table III indicates that the grain yield of sagrain was reduced considerably when soybeans were planted in alternate hills with sagrain even though the crops were continued on the same land for a period of five years and fertilized with commercial nitrogen. However, the total crop was removed from the land, and the soybean grain was not harvested separately and added to the grain yield of sagrain. The quality of forage was also materially improved by the soybeans.

FERTILITY

Since sagrain was so well adapted to the Yazoo-Mississippi Delta as a feed crop and produced such high yields of forage, thereby removing from the soil large amounts of plant food, it was necessary to work out some system of soil maintenance in connection with sagrain production. Various types of soil fertility investigations have been conducted on this Station since 1927.

Direct Applications of Commercial Fertilizers

Sources of Nitrogen

The object of this test was to determine which source of commercial nitrogen would produce the highest yields of grain and forage. Table IV shows the results.

TABLE IV—Commercial Sources of Nitrogen for Sagrain
Annual and Average Yields and Increases
30 Pounds of Nitrogen per Acre

Sources of Nitrogen	1927	1928	1929	1930	1931	1932	1933 *	1934	1935	Average
Yields—bushels of grain per acre										
Check no fertilizer_	60.6	33.5	14.8	16.9	3.0	9.0	---	3.4	3.9	16.1
Calurea -----	66.8	51.6	27.2	25.1	10.0	22.2	---	16.9	12.9	25.0
Calcium nitrate --	71.4	41.3	28.5	21.2	14.1	24.5	---	17.0	14.7	25.0
Sodium nitrate ---	73.5	49.7	27.9	23.0	13.7	25.3	---	12.0	7.2	25.3
Check no fertilizer_	60.6	33.5	14.8	16.9	3.0	9.0	---	3.4	3.9	16.1
Ammonium sulphate	68.3	59.6	32.7	22.9	8.4	20.5	---	15.3	9.8	26.4
Leunaspeter ----	71.5	55.0	27.9	22.0	15.6	22.5	---	13.7	10.3	26.5
Cyanamid -----	66.1	43.9	25.7	19.0	15.9	16.0	---	14.7	9.0	23.4
Check no fertilizer_	60.6	33.5	14.8	16.9	3.0	9.0	---	3.4	3.9	16.1
Increases—bushels of grain per acre										
Calurea -----	6.3	18.0	12.4	8.2	7.0	13.2	---	13.4	9.0	9.8
Calcium nitrate ---	10.9	7.8	13.7	4.3	11.1	15.5	---	13.5	10.8	9.8
Sodium nitrate ---	12.9	16.2	13.1	6.2	10.8	16.3	---	8.6	3.3	9.8
Ammonium sulphate	7.7	26.4	17.9	6.0	5.4	11.5	---	11.9	5.9	10.3
Leunaspeter ----	10.9	21.5	13.1	5.1	12.6	13.5	---	10.3	6.4	10.3
Cyanamid -----	5.5	10.3	10.8	2.1	13.0	6.9	---	11.3	5.1	5.1
Yields—pounds of heads and stover per acre										
Check no fertilizer	11899	6616	3666	7353	5595	4851	4983	4283	3519	5819
Calurea -----	12618	8622	5558	8824	6935	6435	6232	6697	4272	7319
Calcium nitrate --	12987	8199	5694	8665	6847	6422	6118	6657	4652	7319
Sodium nitrate --	12456	8821	4641	8597	7137	6271	5264	5404	4659	7019
Check no fertilizer	11899	6616	3666	7353	5595	4851	4983	4283	3519	5819
Ammonium sul. --	11314	8110	5460	9506	6872	6514	6183	6135	4425	7119
Leunaspeter ----	12456	9956	5324	9623	6979	6284	6152	6214	4264	7419
Cyanamid -----	12148	8897	5577	8393	6468	5851	6363	6138	3704	7019
Check no fertilizer	11899	6616	3666	7353	5595	4851	4983	4283	3519	5819
Increases—pounds of heads and stover per acre										
Calurea -----	718	2003	1892	1471	1340	1584	1249	2414	753	1419
Calcium nitrate --	1087	1583	2028	1312	1252	1572	1135	2374	1133	1119
Sodium nitrate --	557	2205	975	1214	1542	1420	281	1121	1140	1119
Ammonium sul. --	586	1494	1794	2153	1277	1663	120	1852	906	1119
Leunaspeter ----	556	3340	1658	2270	1384	1434	1169	1931	745	1119
Cyanamid -----	248	2281	1911	1040	873	1001	1380	1855	185	1119

* Failed to mature grain because of late germination and dry weather.

In 1927 the unfertilized plots produced approximately 61 bushels of grain per acre. The yields of these same plots decreased rapidly to approximately 4 bushels per acre in 1935. The fertilized plots also decreased gradually from 60 to 70 bushels of grain per acre in 1927 to 7 to 14 bushels in 1935. The stover yields decreased from around 11,900 and above 12,000 pounds in 1927 to 3500 and 4500 pounds per acre in 1935 for the unfertilized and fertilized plots respectively.

As a nine year average all the sources of nitrogen increased the yield 7 to 10 bushels of grain per acre or 45 to 65 percent. The average increase in stover was from 1165 to 1497 pounds per acre or 20 to 27 percent. (See Table IV)

Rates of Applying Ammonium Sulphate

The object of this test was to determine the most economical rate of applying nitrogen on sagrain, and the rate of increase of soil acidity from the use of ammonium sulphate measured in terms of crop yields as the sorghums will not usually grow successfully on very acid soils. Table V shows the results.

**TABLE V—Rates of Applying Ammonium Sulphate on Sagrain
Annual and Average Yields and Increases**

Rate Per Acre	1927	1928	1929	1930	1931	1932	1933 *	1934	1935	Average
Yields—bushels of grain per acre										
Check no fertilizer_	55.7	15.3	9.3	8.8	3.4	4.8	---	1.3	1.8	11.2
7 lbs. per acre --	56.3	23.5	10.8	9.9	5.6	10.5	---	3.6	6.5	14.1
13 lbs. per acre --	64.5	33.2	14.1	13.6	8.0	14.4	---	10.0	11.6	18.8
20 lbs. per acre --	65.6	36.2	15.9	14.7	10.0	23.2	---	11.6	14.6	21.3
Check no fertilizer_	55.7	15.3	9.3	8.8	3.4	4.8	---	1.3	1.8	11.2
7 lbs. per acre --	69.4	41.1	15.2	14.2	10.0	21.8	---	12.7	5.4	21.1
13 lbs. per acre --	76.4	43.3	18.1	16.5	12.8	26.8	---	15.6	11.3	24.5
20 lbs. per acre --	79.8	45.4	17.5	16.3	17.9	25.9	---	14.4	9.9	25.2
Check no fertilizer_	55.7	15.3	9.3	8.8	3.4	4.8	---	1.3	1.8	11.2
Increases—bushels of grain per acre										
7 lbs. per acre --	0.6	8.2	1.5	1.1	2.2	5.7	---	2.3	4.7	2.9
13 lbs. per acre --	8.8	17.9	4.8	4.8	4.6	9.6	---	8.7	9.8	7.6
20 lbs. per acre --	9.9	20.9	6.6	5.9	6.6	18.4	---	10.3	12.8	10.1
7 lbs. per acre --	13.7	25.8	5.9	5.4	6.6	17.0	---	11.4	3.6	9.9
13 lbs. per acre --	20.7	28.0	8.8	7.7	9.4	21.5	---	14.3	9.5	13.3
20 lbs. per acre --	24.1	30.1	8.2	7.5	14.5	21.1	---	13.1	8.1	14.0
Yields—pounds of heads and stover per acre										
Check no fertilizer	11362	5678	3130	5497	4894	4477	4515	3853	3735	5238
7 lbs. per acre_	11587	6082	3900	6697	5926	5383	5432	5077	3393	5942
13 lbs. per acre_	11612	6373	4029	6713	6700	5858	5768	5888	3808	6305
20 lbs. per acre_	12605	6795	4534	7576	7009	6264	6063	6328	4579	6861
Check no fertilizer	11362	5678	3130	5497	4894	4477	4515	3853	3735	5238
7 lbs. per acre_	12606	7329	4563	7217	6718	6745	6330	6459	4432	6933
13 lbs. per acre_	12678	8632	5012	7771	6874	7217	6133	6323	4824	7274
20 lbs. per acre_	13849	8076	5012	8430	7118	7338	6332	6308	4380	7427
Check no fertilizer	11362	5678	3130	5497	4894	4477	4515	3853	3735	5238
Increases—pounds of heads and stover per acre										
7 lbs. per acre --	225	404	770	1200	1032	906	917	1224	—342	704
13 lbs. per acre --	250	695	899	1216	1806	1381	1253	2030	73	1067
20 lbs. per acre --	1243	1117	1404	2079	2115	1787	1548	2475	844	1623
13 lbs. per acre --	1244	1651	1433	1721	1824	2268	1815	2606	697	1695
20 lbs. per acre --	1316	2954	1882	2275	1980	2740	1618	2471	1089	2036
20 lbs. per acre --	2487	2398	1882	2933	2224	2861	1817	2456	645	2189

* Failed to mature grain because of late germination and dry weather.

Table V indicates that the unfertilized plots decreased rapidly from a yield of approximately 56 bushels of grain per acre in 1927 to approximately 2 bushels in 1935 and the stover decreased from 11,362 to 3735 pounds per acre in the same years. The fertilized plots decreased also but the percent increase over the unfertilized plots increased considerably.



Left—225 pounds of ammonium sulphate per acre on sagrain.

Right—Unfertilized sagrain.

The nine year average increase runs from 26% for the lowest rate to 125% for the highest rate for grain production. The nine year average increases run from 13% for the lowest rate to 42% for the highest rate for stover production.

These results indicate that 150 pounds of ammonium sulphate per acre is probably the most economical rate of application for sagrain, and that ammonium sulphate has not increased the acidity of the soil to the extent of reducing the yields.

Dates of Applying Ammonium Sulphate

In 1927 a test was begun to determine the best time to apply nitrogen to sagrain to produce maximum yields. Ammonium sulphate was used. Results of this test are presented in Table VI.

**TABLE VI—Dates of Applying Ammonium Sulphate
30 Pounds of Nitrogen per Acre**

When Applied	1927	1928	1929	1930	1931	1932	Average	
							Yield	Increase
Yields—bushels of grain per acre								
At planting -----	59.8	20.2	11.6	19.8	9.8	29.0	25.1	
12 Inches high -----	70.7	18.6	15.1	22.3	6.3	28.5	26.9	1.8
24 Inches high -----	60.9	25.0	8.9	17.1	5.2	22.0	23.2	—1.8
No fertilizer -----	60.0	14.5	6.1	15.1	1.8	6.3	17.3	—7.8
At planting -----	59.8	20.2	11.6	19.8	9.8	29.0	25.1	
Yields—pounds of heads and stover per acre								
At planting -----	11954	6519	4503	9024	7288	8525	7969	
12 Inches high -----	12852	5932	5629	8156	9614	8928	8519	550
24 Inches high -----	11555	5999	5263	7881	9322	9250	8212	243
No fertilizer -----	10924	5810	4240	6630	5523	5235	6394	—1575
At planting -----	11954	6519	4503	9024	7288	8525	7969	

Table VI indicates that slightly higher yields of both grain and total forage were obtained when the nitrogen (from ammonium sulphate) was applied at the time the sagrain was approximately 12 inches high.

Indirect Applications of Commercial Fertilizers

In 1927 sagrain was added to a test that had been running since 1921. This experiment consisted of sources of nitrogen, rates of applying sodium nitrate and dates of applying sodium nitrate with cotton, oats and corn. The sagrain was placed in the test as a crop following the oats and was not fertilized directly but given the benefit of any fertilizer that the oats failed to utilize. The cotton, oats and corn were fertilized just the same each year and rotated as named, with sagrain following the oats in the summer of the same year. For several years (1929-32) sagrain failed to produce mature grain apparently due to a lack of moisture following oats, and during the two years, 1930-1931, sagrain was practically a failure and no yields were taken.

Source of Nitrogen

Table VII shows the results of the sources of nitrogen used.

TABLE VII—Residual Effect of Sources of Nitrogen Applied to a Previous Crop of Oats

Sources of Nitrogen	1927	1928	1929	1932	1933	1934	1935	Average
Yields—bushels of grain per acre								
Check no fertilizer	30.4	14.1	---	---	5.5	15.8	7.4	8.1
Sodium nitrate	32.3	12.0	---	---	8.2	15.4	10.5	8.7
Ammonium sulphate	34.6	10.7	---	---	8.9	16.1	10.3	9.0
Ammonium sulphate	33.9	11.9	---	---	8.2	15.9	8.2	8.7
Check no fertilizer	30.4	14.1	---	---	5.5	15.8	7.4	8.1
Cyanamid	33.8	14.7	---	---	9.3	13.3	11.8	9.2
Cotton seed meal	36.9	16.1	---	---	10.4	15.7	7.9	9.7
½ C.S.M. & ½ s. nitrate	35.2	16.4	---	---	10.3	15.8	7.9	9.5
Check no fertilizer	30.4	14.1	---	---	5.5	15.8	7.4	8.1
Increases—bushels of grain per acre								
Sodium nitrate	1.9	—2.1	---	---	2.8	—0.3	3.1	0.6
Ammonium nitrate	4.2	—3.4	---	---	3.4	0.4	2.8	0.8
Ammonium sulphate	3.5	—2.2	---	---	2.7	0.1	0.8	0.6
Cyanamid	3.4	0.6	---	---	3.9	—2.5	4.4	1.1
Cotton seed meal	6.5	2.0	---	---	5.0	—0.1	0.4	1.5
½ C.S.M. & ½ s. nitrate	4.8	2.3	---	---	4.8	0.0	0.5	1.4
Yields—pounds of heads and stover per acre								
Check no fertilizer	7527	6980	2289	2580	4069	4474	4334	3584
Sodium nitrate	8988	7736	1404	3701	3779	4731	3831	3797
Ammonium nitrate	8405	5588	1620	3414	4782	4800	4437	3672
Ammonium sulphate	7584	6700	1314	3352	4310	4585	3886	3526
Check no fertilizer	7527	6980	2289	2580	4069	4474	4334	3584
Cyanamid	7752	7703	1854	3752	4430	4726	4969	3910
Cotton seed meal	8135	8500	2257	3895	4951	5300	4929	4219
½ C.S.M. & ½ s. nitrate	8225	6970	1606	3137	4491	4900	4339	3741
Check no fertilizer	7527	6980	2289	2580	4069	4474	4334	3584
Increases—pounds of heads and stover per acre								
Sodium nitrate	1461	756	—885	1121	—290	258	—503	213
Ammonium nitrate	878	—1392	—669	834	713	326	103	88
Ammonium sulphate	57	—281	—975	772	241	112	—448	—58
Cyanamid	225	713	—435	1172	360	252	635	325
Cotton seed meal	608	1520	—33	1315	882	826	595	635
½ C.S.M. & ½ s. nitrate	698	—10	—683	558	421	426	5	157

Table VII indicates that most of the nitrogen was used up by the oats, but greater residual effects on sagrain were obtained with the less soluble sources of nitrogen. Probably the higher yields of oats left a moisture deficiency which resulted in a lower succeeding sagrain yield.

Rates of Applying Sodium Nitrate

The data for the rates of applying sodium nitrate are shown in Table VIII.

TABLE VIII—Residual Effect of Rates of Applying Sodium Nitrate Applied to a Previous Crop of Oats

Rate per Acre	1927	1928	1929	1932	1933	1934	1935	Average
Yields—bushels of grain per acre								
Check no fertilizer -----	33.2	11.2	---	---	10.8	13.6	6.2	8.3
50 lbs. Sodium nitrate --	33.9	11.1	---	---	11.3	12.9	5.7	8.3
100 lbs. Sodium nitrate --	34.4	8.4	---	---	14.8	12.7	6.0	8.5
150 lbs. Sodium nitrate --	31.2	12.1	---	---	10.7	11.9	5.8	8.0
Check no fertilizer -----	33.2	11.2	---	---	10.8	13.6	6.2	8.3
200 lbs. Sodium nitrate --	34.1	10.3	---	---	14.5	10.5	7.0	8.5
250 lbs. Sodium nitrate --	38.2	8.2	---	---	15.7	7.8	8.6	8.7
300 lbs. Sodium nitrate --	39.5	9.0	---	---	13.1	7.7	8.0	8.6
Check no fertilizer -----	33.2	11.2	---	---	10.8	13.6	6.2	8.3
Increases—bushels of grain per acre								
50 lbs Sodium nitrate ----	0.8	—0.1	---	---	0.5	—0.7	—0.5	0.0
100 lbs. Sodium nitrate ----	1.2	—2.8	---	---	4.0	—0.9	—0.2	0.5
150 lbs. Sodium nitrate --	—2.0	0.9	---	---	—0.2	—1.7	—0.3	—0.5
200 lbs. Sodium nitrate ----	0.9	—0.9	---	---	3.7	—3.1	0.9	0.5
250 lbs. Sodium nitrate ----	5.0	—3.1	---	---	4.9	—5.8	2.4	0.0
300 lbs. Sodium nitrate ----	6.3	—2.3	---	---	2.3	—5.9	1.8	0.0
Yields—pounds of heads and stover per acre								
Check no fertilizer -----	6875	5745	2043	3099	5960	3960	4187	3540
50 lbs. Sodium nitrate --	7850	5582	2357	2992	6090	3903	4192	3660
100 lbs. Sodium nitrate --	8155	5562	1924	2654	5952	3820	4337	3600
150 lbs. Sodium nitrate --	8666	5665	1743	2874	5267	4016	3752	3550
Check no fertilizer -----	6875	5745	2043	3099	5960	3960	4187	3540
200 lbs. Sodium nitrate --	5927	4749	1831	3252	6306	3884	4497	3380
250 lbs. Sodium nitrate --	9712	4728	1699	2992	6583	3933	4821	3830
300 lbs. Sodium nitrate --	9424	5010	1272	3229	5977	3486	4364	3640
Check no fertilizer -----	6875	5745	2043	3099	5960	3960	4187	3540
Increases—pounds of heads and stover per acre								
50 lbs. Sodium nitrate --	975	—163	314	—108	130	—57	5	12
100 lbs Sodium nitrate --	1280	—183	—119	—445	—8	—140	150	5
150 lbs. Sodium nitrate --	1791	—80	—300	—225	—693	56	—435	1
200 lbs. Sodium nitrate --	—918	—996	—212	153	346	—76	310	—15
250 lbs. Sodium nitrate --	2837	—1017	—344	—107	623	—27	634	28
300 lbs. Sodium nitrate --	2549	—735	—771	130	17	—474	177	9

Table VIII indicates that the different rates of application of sodium nitrate to a crop of oats had little, if any residual effect on a succeeding crop of sagrain. In several cases the yields were decreased on the fertilized plots, presumably from a moisture and perhaps an available plant food deficiency caused by high preceding oat yields.

Dates of Applying Sodium Nitrate

Table IX shows the results of the residual effect of various dates of applying sodium nitrate to a previous crop of oats on a crop of sagrain.

TABLE IX—Residual Effect of Dates of Applying Sodium Nitrate to a Previous Crop of Oats

Date of Application	1927	1928	1929	1932	1933	1934	1935	Average
Yields—bushels of grain per acre								
check no fertilizer -----	37.0	10.0	---	---	10.2	10.2	12.2	8.8
at planting -----	44.3	10.2	---	---	10.9	6.7	15.7	9.8
March 15 -----	41.9	9.4	---	---	8.2	5.1	21.8	9.6
April 1 -----	45.2	11.5	---	---	8.7	5.0	24.3	10.5
check no fertilizer -----	37.0	10.0	---	---	10.2	10.2	12.2	8.8
April 15 -----	43.2	10.2	---	---	10.2	5.7	20.0	9.9
½ Pltg., ½ April 1 -----	41.7	11.3	---	---	8.8	5.2	20.7	9.7
½ Pltg., ½ April 15 -----	49.0	10.0	---	---	11.2	5.2	19.2	10.5
check no fertilizer -----	37.0	10.0	---	---	10.2	10.2	12.2	8.8
Increases—bushels of grain per acre								
at planting -----	7.9	0.2	---	---	0.7	—3.6	3.4	1.0
March 15 -----	4.9	—0.6	---	---	—2.0	—5.1	9.5	0.7
April 1 -----	8.2	1.5	---	---	—1.6	—5.2	12.1	1.7
April 15 -----	6.3	0.2	---	---	0.0	—4.5	7.8	1.1
½ Pltg., ½ April 1 -----	4.8	1.2	---	---	—1.4	—5.1	8.4	0.9
½ Pltg., ½ April 15 -----	12.0	0.0	---	---	1.0	—5.0	6.9	1.7
Yields—pounds of heads and stover per acre								
check no fertilizer -----	7848	6094	1998	3835	3860	3637	7277	3839
at planting -----	8654	5292	1550	3362	4371	3449	5713	3599
March 15 -----	8233	5199	1552	3923	3763	3285	7395	3706
April 1 -----	9139	5354	1298	3925	4026	3319	8551	3957
check no fertilizer -----	7848	6094	1998	3835	3860	3637	7277	3839
April 15 -----	8382	5477	1363	4098	4597	3678	8652	4027
½ Pltg., ½ April 1 -----	8582	5389	1470	3609	4171	3701	9239	4018
½ Pltg., ½ April 15 -----	9421	5408	1566	3669	3754	3458	9062	4038
check no fertilizer -----	7848	6094	1998	3835	3860	3637	7277	3839
Increases—pounds of heads and stover per acre								
at planting -----	806	—802	—448	—473	511	—188	—1564	—240
March 15 -----	385	—895	—446	88	—97	—352	118	—133
April 1 -----	1291	—740	—700	90	166	—318	1274	118
April 15 -----	534	—617	—635	263	737	41	1375	189
½ Pltg., ½ April 1 -----	734	—705	—528	—226	311	64	1962	179
½ Pltg., ½ April 15 -----	1573	—686	—432	—166	—106	—180	1785	198

The results in Table IX indicate that there were slight residual effects on the sagrain from the later applications of sodium nitrate, but in some cases all yields of sagrain were reduced from the use of sodium nitrate on the preceding crop of oats.

Tables VII, VIII, and IX indicate that only slight residual effects on a succeeding crop should be expected from applications of commercial nitrogen applied to a preceding crop of oats.

Residual Effect of Sagrain, Corn, and Varieties of Soybeans on a Succeeding Crop of Cotton

As sagrain produces heavily and removes much plant food from the soil, and since some varieties of soybeans produce higher yields than others, thereby adding more nitrogen to the soil, a test was started in 1928 to determine which variety of soybeans would increase or maintain soil fertility when grown with sagrain.

Corn was added to the test to compare the residual effect of corn and soybeans with that of sagrain and soybeans. The plan was to grow cotton as a succeeding crop to measure the residual effect of the different varieties of soybeans in the sagrain and corn. Table X presents the results of this work.

**TABLE X—Sagrain, Corn and Varieties of Soybeans and
Residual Effect of Same on a Succeeding Crop of Cotton**

Crops grown	1928	1929	1930	1931	1932	Average	
						Yield	Increase
Total yields—pounds of sagrain, corn and soybeans per acre							
Sagrain & Geo. Wash. soybeans----	7775	2700	6041	5877	5658	5610	
Corn & Biloxi soybeans-----	6930	3690	1166	4230	2903	3784	—1820
Sagrain & Biloxi soybeans -----	7606	3618	6530	6091	5731	5915	302
Sagrain & Loxitan soybeans -----	7845	3492	6757	6136	5730	5992	383
Sagrain & Tokyo soybeans -----	8752	3582	5960	6166	4717	5835	221
Sagrain & Geo. Wash. soybeans----	7775	2700	6041	5877	5658	5610	
Yields of succeeding cotton crops—seed cotton in pounds per acre							
Sagrain & Geo. Wash. soybeans ---		1834	705	573	679	758	
Corn & Biloxi soybeans -----		2026	683	797	723	846	8
Sagrain & Biloxi soybeans -----		2008	808	567	768	830	7
Sagrain & Loxitan soybeans -----		1916	684	657	659	783	2
Sagrain & Tokyo soybeans -----		1890	735	608	743	795	3
Sagrain & Geo. Wash. soybeans ---		1834	705	573	679	758	

The results in Table X indicate very little variation in yields of sagrain and different varieties of soybeans, but sagrain and soybeans produced considerably higher yields than corn and the same variety of soybeans. The yields of succeeding cotton crops indicate that slightly higher yields were obtained from the residual effects of Biloxi soybeans than from the other varieties. The 4 year average cotton yields show practically no difference between the residual effect of sagrain and soybeans and corn and soybeans.

SAGRAIN PASTURE

For several years this station has been pasturing sagrain with mules and logs. No experimental results are available, but general opinions have been formed in connection with this practice.

From general observations it seems that 1½ acres of sagrain and soybeans per head is sufficient to carry mules through the summer and fall idle period (July 15-December 15). If the pasture is planted on good land or well fertilized, the acreage can probably be reduced 25 to 50%.

Hogs were usually turned in after the mules were taken off the pasture to utilize the feed wasted by the mules. Some economical gains have also been obtained with hogs by pasturing them on fields of sagrain that have not been previously pastured by mules.



This 16-acre sagrain pasture provided both grain and roughage for 20 station mules during the fall idle period.



These 20 mules gained 1646 pounds on the above sagrain pasture the first 33 days or an average of 2.5 pounds per mule per day.

SAGRAIN SHOCKING

In 1927 a test was conducted to determine the most economical and satisfactory method of curing and winter storing sagrain forage in the open.

The following types of shocks were put up in duplicate on December 5, 1927 and torn down and notes made March 12, 1928.

1. Shocks 14 feet long and 2 bundles thick on each side of ridge pole.
2. Shocks 14 feet long and 4 bundles thick on each side of ridge pole.
3. Round shocks containing 12 bundles.
4. Round shocks containing 24 bundles.
5. Round shocks containing 24 bundles at the base and shingled with 12 more bundles.

Ridge poles $3\frac{1}{2}$ feet high were used in plots 1 and 2.

Posts in center of shocks were used in plots 3, 4 and 5.

The 14 foot long and two bundles thick shocks seemed to be the most practical method of curing and storing sagrain in the open. The bundles were cured sufficiently, remained dry throughout with practically no mold present. This method could be used on pasture and other fences very economically. The heads should be covered to prevent birds from destroying the grain.

When the 14 foot shocks were increased to four bundles thick the inside bundles failed to cure properly and were wet and molded.

The sagrain in the 12 bundle round shock was in better condition than in any of the methods used, but this method required too much time, labor, space and expense as compared to shocking around a permanent farm fence.

The round shock containing 24 bundles were in fair condition and required less time, labor, space and expense than the 12 bundle round shocks.

The shingled round shock was an absolute failure. The bundles fell down on the ground, and were wet and molded.



A field of shocked sagrain on a Yazoo-Mississippi Delta plantation.



Combining sagrain on a Yazoo-Mississippi Delta plantation.

SUMMARY

The results of nine years of experimental work with sagrain at the Delta Experiment Station consisting of dates of seeding, spacing, soil fertility, pasture and shocking investigations may be summarized as follows:

1. Sagrain produced highest yields of grain on a Sharkey sandy loam soil when planted April 15 and highest yields of forage when planted May 1-15.
2. In hills 13 inches apart on Sharkey clay loam soil 4 to 6 plants per hill produced the highest average yields of grain and 5 or more plants produced the highest forage yields of sagrain alone. Six or more plants per hill produced highest yields of both grain and stover with soybeans in alternate hills. The soybeans reduced the sagrain yields considerably when the total crop was removed from the land each year, however the grain from the soybeans and the better quality feed offset the reduced yields of sagrain.
3. As a nine year average the six commercial sources of nitrogen at the rate of 30 pounds of nitrogen per acre increased the yields as follows: Calurea, 9.8 bushels per acre; calcium nitrate, 9.8 bushels; sodium nitrate, 9.7 bushels; ammonium sulphate, 10.3 bushels; leunaspeter, 10.4 bushels; and cyanamid, 7.3 bushels per acre. The average check yield was 16.1 bushels per acre.
4. The most economical rate of applying ammonium sulphate was 150 pounds per acre.
5. Slightly higher yields of both grain and total forage were obtained when the nitrogen (from ammonium sulphate) was applied at the time the sagrain was approximately 12 inches high.
6. Only very slight residual effects on sagrain were obtained from applications of commercial nitrogen on a preceding crop of oats.
7. Considerably higher yields were obtained with sagrain and soybeans than corn and soybeans and the succeeding cotton yields were practically the same. Slightly higher yields of cotton were obtained from the residual effects of Biloxi soybeans than from the other varieties used with sagrain.
8. One and one half acres of sagrain and soybeans per head were sufficient to carry mules through the summer and fall idle period (July 15 to Dec. 15).
9. Sagrain forage shocked two bundles thick on each side of a ridge pole or farm fence was the most satisfactory and economical method of curing and storing during the winter in the open.

AN ALLUVIAL EMPIRE

THE YAZOO-MISSISSIPPI DELTA

THE GARDEN SPOT OF AMERICA

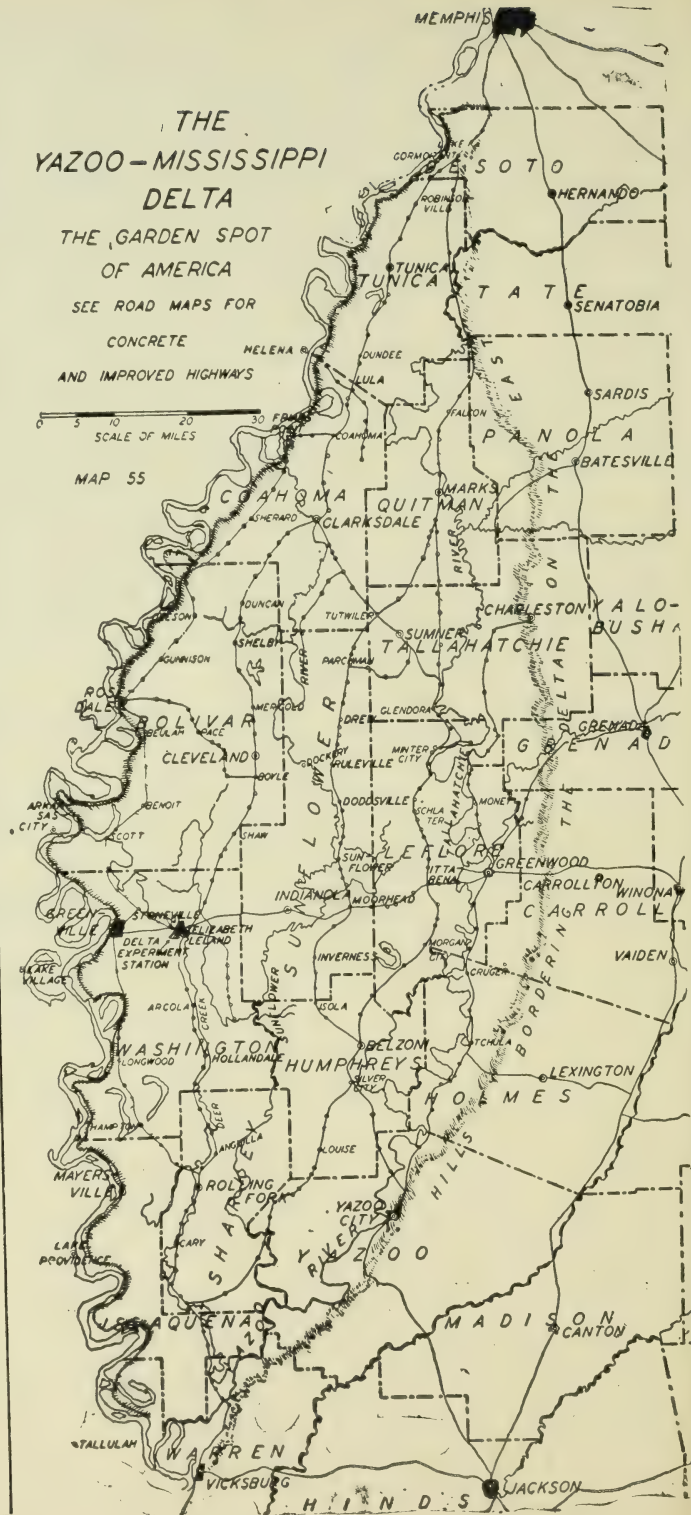
SEE ROAD MAPS FOR

CONCRETE

AND IMPROVED HIGHWAYS

0 5 10 20 30 MILES
SCALE OF MILES

MAP 55



A Compilation of
EXPERIMENTAL
And Other
DATA ON
Harvesting, Curing, Marketing and Feeding
SWEET POTATOES

Compiled by
C. F. CLARK
Coordinator Research Information

Jointly Representing
MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
and
MISSISSIPPI STATE VOCATIONAL BOARD

J. R. RICKS, Director
Mississippi Agricultural Experiment Station
State College, Mississippi

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A. HARVESTING SWEET POTATOES

When should sweet potatoes be harvested in relation to frost dates to prevent rot? When should they be dug for the highest cash income per acre?

How may sweet potato vines be removed?

Sweet potatoes are usually graded at digging time. What constitutes a No. 1 potato? No. 2 potato?

I

Comparison of Keeping and Eating Qualities of Potatoes Dug Before and After Vines Were Frosted at Auburn, Alabama

To test the effect of frosted vines on the keeping and eating qualities of sweet potatoes, Triumph and Porto Rico varieties were planted at the same time, in the same field, in similar soils, and grown under similar cultural conditions. This assured uniformity of product.

For this test:

1. One lot of potatoes was dug before frost and cured in a storage house.
2. A second lot was dug before frost and banked in the regular way with pine straw.
3. Five to ten days after the vines were frosted a third lot was dug and placed in the storage house.
4. A fourth lot was dug 5 to 10 days after the vines were frosted and placed in banks.

The third and fourth lots were treated as nearly like the first and second lots as possible. This treatment was as follows: Potatoes in storage were carried through a curing process ten to twelve days at a temperature varying from 80 to 90 degrees F., then lowered to a temperature of 50 to 60 degrees F., and kept as near this temperature as possible.

Preparatory to banking, potatoes were carefully sorted and piled on a thick layer of pine straw, covered carefully each night to keep off dew and prevent chilling, and uncovered each day to allow drying by the sun. This was done for three days, and the potatoes were then covered with a layer of pine straw 6 inches thick and 8 inches of soil.

A hole five inches in diameter was left in the top of the bank for ventilation. Pine straw was stuffed into the ventilator in the top of the bank during low temperature periods. A wooden box about 2 feet square was turned over the top to keep out rain. It was removed on warm, sunny days if the top of the bank had the appearance of sweating. The bank was not disturbed throughout the storage period. A thermograph was used for recording the temperature in the bank.

**Table 1—Effect of Digging Sweet Potatoes before and After Vines are Frosted
When Stored in House and in Bank—1918-19, Auburn, Alabama**

Lot No.	Variety	No. Bu.	When Dug	Stored	Examined	Loss %
1918						
1	Triumph	100	Before frost	In bank Nov. 15, 1918	March 18, 1919	5.0
2	Triumph	10	Before frost	In bank Nov. 15, 1918	March 18, 1919	5.0
3	Triumph	10	Ten days after frost	In bank Dec. 13, 1918	March 18, 1919	85.0
4	Triumph	1	Ten days after frost	In house Dec. 13, 1918 (Not cured)	March 22, 1919	96.0
5	Porto Rico.....	50	Before frost	In house Nov. 7, 1918	April 15, 1919	0.8
6	Porto Rico.....	10	Before frost	In bank Nov. 15, 1918	March 18, 1919	0.32
7	Porto Rico.....	10	Ten days after frost	In bank Dec. 13, 1918	March 18, 1919	50.0
8	Porto Rico.....	1	after frost	In house (Not cured)	March 22, 1919	75.0
1919						
9	Triumph	100	Before frost	In house Nov. 5, 1919	April 12, 1920	0.4
10	Triumph	10	Before frost	In bank Nov. 5, 1919	April 7, 1920	0.7
11	Triumph	5	Five days after frost	In house Dec. 19, 1919	April 7, 1920	80.0
12	Triumph	4	Five days after frost	In house Dec. 19, 1919	April 12, 1920	75.0
13	Porto Rico.....	100	Before frost	In house Nov. 5, 1919	April 12, 1920	0.8
14	Porto Rico.....	10	Before frost	In bank Nov. 5, 1919	April 7, 1920	1.25
15	Porto Rico.....	5	Five days after frost	In house Dec. 19, 1919	April 7, 1920	75.0
16	Porto Rico.....	6	Five days after frost	In house Dec. 19, 1919	April 12, 1920	71.0

Potatoes that were dug before and after frost were taken from banks and house and baked with the following observations:

Triumphs dug before frost were in excellent condition, had no discoloration, were sweet, soft, uniform in texture, stringless, excellent in quality, had good color, and were free from lumps.

Triumphs dug five days after frost had killed the vines, showed discoloration and pithiness when cut. When baked they were lumpy, slightly stringy, and had a poor quality. They showed dark streaks throughout, had a bad taste and odor, and were unfit for food.

Porto Ricos dug before frost kept in good condition. When baked they were soft, sweet, juicy, tender, uniform in texture, and good in color, flavor and quality.

Porto Ricos dug five days after frost had killed vines showed discoloration and pithiness when cut. When baked they showed air spaces and were stringy, lumpy, wet, poor in texture and flavor, and showed discoloration throughout. They were unfit for food.

Both varieties dug before frost appeared healthy and, when bedded, produced good sprouts in due time while those dug after frost and cured in house appeared dead and did not produce good sprouts. Those dug after frost and stored in bank had a tendency to sprout before the regular season. What might be termed a second growth took place, making the potatoes unmarketable. This was due to heating caused by the rapid decay of a large portion of the total lot.

Reference: Alabama Experiment Bulletin 220, November 1923, Pages 4-6, "Harvesting and Storing Sweet Potatoes," Agricultural Experiment Station of the Alabama Polytechnic Institute, Auburn, Alabama.

II

At Experiment, Georgia in April, 1911, two varieties of potatoes—the Golden Beauty and Enormous were set out. Half of the plats were harvested early in September and the other half in November, after a light frost. The yields were compared to ascertain the loss or gain from early digging. The following table gives the results:

Table 2—Comparison of Yields of Two Varieties of Potatoes When Dug on September 11 and November 11, 1911

Variety	Date of Harvest	Yield Per Acre
Golden Beauty	September 11	65.7
Golden Beauty	November 11	348.4
Enormous	September 11	177.2
Enormous	November 11	255.8

Reference: Georgia Agricultural Experiment Station Bulletin 107, page 91, table 6, March 1914, "Sweet Potatoes, Culture, Storing and Studies in Fertilizing," Experiment, Georgia.

III

**Table 3—Effect of Different Harvesting Dates of Sweet Potatoes at Tifton, Georgia
Average Planting Date—April 10th
Yield in Bushels Per Acre
6 Year Average—1922-1927 Inclusive**

Harvesting Date	No. 1's	No. 2's	Jumbo's	Strings	Total Yield	Av. Number Growing Days
July 1	7	5	0	10	22	81
July 15	20	12	0	12	44	95
August 1	50	18	0	20	88	111
August 15	60	21	6	22	109	125
September 1	83	28	7	23	141	141
September 15	110	29	14	19	172	156
October 1	119	35	16	25	195	171
October 15	135	37	18	22	212	186
November 1	130	42	32	22	226	201

Reference: Georgia Coastal Plain Experiment Station, Bulletin 17, page 44, Table XXV, "Sweet Potato Culture in the Coastal Plain of Georgia," Tifton, Georgia.

IV

Removing Vines at Digging Time

Any farmer may make a sweet potato vine cutter at a cost of not more than a dollar for new material, and the average farmer can scrap up enough material to make one with practically no cost at all. The material necessary to make one of these implements is:

- 4 pieces of 2" x 4" timber 4 feet long
- 3 pieces of 1" x 12" plank 30 inches long
- 1 dozen spikes
- ½ pound of 8d nails
- 1 piece of trace chain or heavy wire
- 20 mowing machine sections, (old ones that have been removed from blades will do just as well as new ones)

This list of material is for a cutter adapted to three and a half foot rows, as the outer sections should run six inches from the row. Measure several rows and make the implement twelve inches less than the width of the average row.

This cutter is made by placing one two-by-four edgewise and another two-by-four flatwise on it, with the edge of the flat piece in line with the flat side of the piece setting edgewise and nailing with spikes. Two pieces or runners are made this way. Place the two runners so that the last two-by-four will be the inside of the

sled and the other two-by-four two inches off of the ground. The mowing machine sections are nailed to the outer edge of the runner and to the outer edge of the two-by-four extension. The one inch boards are nailed on top to form the sled.

This implement is too light to cut the vines of its own weight, so a man or a boy may ride it, running the implement between the rows, and at the end, lifting it over into the next row, and so on.

Reference: Mississippi Agricultural Experiment Station, Circular 84, pages 2 and 3, October 1929, "A Simple Sweet Potato Vine Cutter," State College, Mississippi.

For another method of removing vines, see explanation accompanying Table 5.

V

The official grades for South Carolina for sweet potatoes are the same as the United States grades. They are given below:

Grade 1—Diameter, $1\frac{3}{4}$ inches to $3\frac{1}{2}$ inches; length 3 inches to 10 inches.

Note the following exceptions: The length may be less than three inches if the diameter is two inches or more.

Grade 2—Diameter, $1\frac{1}{2}$ inches to 4 inches; length, any length.

U. S. No. 1 shall consist of sweet potatoes of similar varietal characteristics which are firm, not badly misshapen; free from black rot, decay and freezing injury; and free from damage caused by dirt, secondary rootlet, bruises, cuts, scars, growth cracks, scald, scurf, or other diseases, weevils or other insects, and mechanical or other means.

Tolerances—In order to allow for variations other than size incident to proper grading and handling, not more than 10 percent by weight of the sweet potatoes in any lot may be below the requirements of this grade, but not to exceed a total of 5 percent shall be allowed for defects causing serious damage, and not more than one-fifth of this amount or one percent shall be allowed for sweet potatoes affected with soft rot.

In addition not more than 10 percent by weight of the sweet potatoes in any lot may not meet the size requirements, but not more than one-half of this tolerance or 5 percent shall be allowed for sweet potatoes which are below the minimum size requirements.

U. S. No. 2 shall consist of sweet potatoes of similar varietal characteristics which are firm; free from black rot, decay and freezing injury; and free from serious damage caused by dirt, bruises, cuts, scars, growth cracks, scald, disease, weevils or other insects and mechanical or other means.

Tolerances—In order to allow for variations other than size incident to proper grading and handling, not more than 10 percent by weight of the sweet potatoes in any lot may be below the requirements of this grade, but not to exceed one-tenth of this amount or one percent shall be allowed for sweet potatoes affected with soft rot.

In addition not more than 10 percent by weight of the sweet potatoes in any lot may not meet the size requirements, but not more than one-half of this tolerance or 5 percent shall be allowed for sweet potatoes which are below the minimum size requirements.

U. S. Fancy shall consist of sweet potatoes of similar varietal characteristics

which are firm, smooth and well-shaped; free from black rot, decay and freezing injury; and free from damage caused by dirt, secondary rootlets, bruises, cuts, scars, growth cracks, scale, scurf or other diseases, weevils or other insects and mechanical or other means.

The diameter of each sweet potato shall not be less than 2 inches, nor more than 3½ inches, and the length shall be not less than 3 inches nor more than 6 inches, but the length may be less than 3 inches if the diameter is 2¼ inches or more.

Tolerances—In order to allow for variations other than size incident to proper grading and handling not more than 10 percent by weight of the sweet potatoes in any lot may be below the requirements of this grade, but not to exceed a total of 3 percent shall be allowed for defects causing serious damage and not more than one-third of this amount or one percent shall be allowed for sweet potatoes affected with soft rot.

In addition not more than 10 percent by weight of the sweet potatoes in any lot may not meet the size requirements, but not more than one-half of this lot tolerance or 5 percent shall be allowed for sweet potatoes which are below the minimum size.

Unclassified shall consist of sweet potatoes which are not graded in conformity with any of the foregoing grades.

Definition of Terms

“Similar varietal characteristics” means that the sweet potatoes in the same container shall have skins of similar color, such as white, yellow or red. Moist and dry types shall not be mixed.

“Firm” means that the sweet potato shall not be flabby or shriveled.

“Badly misshapen” means that the sweet potato is so misshapen as to cause a waste for ordinary use of more than 20 percent by weight of the potato.

“Damage” means any injury which materially affects the appearance of the lot or causes appreciable waste in the ordinary preparation for use.

“Serious damage” means any injury not included misshapen potatoes which seriously affects the appearance of the lot or causes a waste of more than 20 percent by weight in the ordinary preparation for use. Black rot shall be considered as serious damage.

“Diameter” means the greatest dimensions at right angles to the longitudinal axis.

“Smooth” means that in addition to other defects which cause roughness, sweet potatoes shall be free from prominent veining.

Reference: South Carolina Extension Service Bulletin 84, pages 17, 18, and 19, April 1927, “The Sweet Potato Industry,” Clemson Agricultural College, Clemson College, South Carolina.

VI

Table 4—Date of First Killing Frost at Various Points in Mississippi 1918-1934

Year	Poplarville*	Hattiesburg	Jackson	State College	Tupelo
1918	December 2	November 14	November 13	November 24	November 1
1919	.....	November 14	November 14	November 13	November 13
1920	.....	.....	November 13	November 12	October 29
1921	.....	November 11	November 11	November 11	.....
1922	December 22	November 21	November 29	November 21	November 21
1923	November 18	November 10	November 7	October 22	October 25
1924	November 25	October 24	November 19	October 23	October 23
1925	.....	November 16	November 23	October 20	October 20
1926	November 11	November 5	October 25	October 25	October 25
1927	November 18	November 18	November 18	November 18	November 18
1928	November 21	November 21	November 21	November 11	November 11
1929	November 30	November 30	November 23	November 5	November 5
1930	November 1	October 31	October 31	October 31	October 31
1931	None	November 1	November 1	November 7	November 7
1932	November 12	November 12	November 12	November 12	November 12
1933	November 8	November 9	November 8	November 8	November 8
1934	November 12	November 12	November 12	November 12	November 12

*McNeill instead of Poplarville during 1918 and 1919.

Reference: Annual Climatological Data, Weather Bureau, U. S. Department of Agriculture, 1918-1934.

For a comparison of careful versus commercial harvesting of sweet potatoes see tables 15 and 17.

For other information see explanation in connection with Table 5.

B. STORING SWEET POTATOES.

1. ROT AND MOISTURE LOSSES OF SWEET POTATOES IN STORAGE

How does the loss of sweet potatoes from rot in storage house compare with that from potatoes stored in banks?

How does the loss of moisture compare in the two methods of storing?

Use Form 1 for getting the comparative value of various methods of storing.

Table 5—Results of Tests On Storage of Sweet Potatoes in Alabama

A. Auburn

Year	Variety	Bushels in Storage House	% Of Loss by Decay in House March 1st	% of Loss by Decay in House May 1st	Bushels Stored in Banks	Percent of Loss By Decay in Bank March 1
1914-15	Triumph	24	5.5	None in storage	20	100
	Nancy Hall	35	11	None in storage	20	100
1915-16	Triumph	107	4	7	16	11
	Nancy Hall	74	5.8	7.4	10	9
1916-17	Triumph	60	.5	1.7	9	10
	Nancy Hall	26	2	5	9	10
	Porto Rico	84	2.8	3.5	This variety not banked	

B. Storage at Montgomery in cooperation with Mrs. Bellamy

1915-16	Triumph	427	3	3.5	450	7.5
1916-17	Triumph	347	4.5	None in storage	10	80

C. Storage at Greenville in cooperation with J. E. Helms

1915-16	Triumph	200	2.5	Reported average of community loss by decay in banks 45%		
1916-17	Triumph	300	1.5			

D. Storage near Auburn in cooperation with J. A. Cullars

1914-15	Nancy Hall	Did not have house			50	100
1915-16	Nancy Hall	100	10	None in storage	15	80
1916-17	Nancy Hall	60	2	Would not bank		

The potatoes stored at Auburn in banks as a part of this experiment, were taken immediately from the field and banked as practiced by farmers near Auburn. The sweet potato storage house had not been completed at Auburn at this time. Therefore, for that reason in 1914 the banked potatoes had an advantage in prompt handling over the house-stored potatoes. The records for 1915-16 and 1916-17 show a more accurate comparison between house and bank storage because the house once completed was ready each year and potatoes were stored as soon as dug, and cured promptly.

In addition to the work done at Auburn, arrangements were made with three farmers to cooperate on storing sweet potatoes in banks and in houses.

The room used by Mrs. Bellamy was one room of the servant's cottage, without floor or ceiling ventilators. A grate fire was used to secure heat for curing. The only loss was in the lower corners of the bins farthest from the grate, which indicates that the potatoes in that portion of the bins may not have been properly cured.

The house used by Mr. Helms at Greenville, was a worked-over outhouse. Mr. Helms very kindly secured data on losses in his community from storing in banks, which was an average of 45 percent for the two years. He states that his average loss by banking his potatoes for the past twenty-five years had been 75 percent and that he had saved more than enough the first year in the storage house to pay for it. He also stated that the house was worth its cost because of the increased richness and sweetness of the cured potatoes.

The results of the cooperative experiments with Mr. J. A. Cullars of Auburn, show a total loss of banked potatoes in 1914-1915. In 1915-1916 he built a small house holding one hundred bushels. The house was not properly ventilated for the first few days during curing, and this probably accounts for a part of his loss of ten percent from decay. However, this loss is small when compared with the loss of 80 percent occurring in banks. His average loss for two years by banking was 90 percent as compared with 6 percent loss in his storage house. Mr. Cullars stated that even if the percent of loss were the same, the house was worth its cost because of the better quality of the cured potatoes.

Making the Experimental Storage Room

In making the house storage experiments at Auburn, as reported here, one large room of a negro cabin standing on the Experiment Station grounds, was remodeled during the fall of 1914 as follows:

The cracks in the rough board walls were covered on the outside with one-half by three inch strips. The walls inside were covered with building paper. The rough board floor was covered with building paper and a tongue and groove floor was laid over this and at right angles to the boards of the first floor. Care was taken to join the floor carefully to the outer walls so as to keep out rodents or air. Two by four inch scantlings were set vertically two feet apart around the walls and a layer of paper tacked upon these. This provided a four inch dead air space between the two by fours from floor to ceiling, thus giving excellent protection from sudden changes of temperature.

The walls were then ceiled with the same material as that used for the floor. The rough board ceiling was simply covered with building paper during the first season, but was also ceiled at the beginning of the second year. The effect of this change is clearly shown by the much more constant temperatures maintained the second year.

The windows on the north and east sides of the house were replaced by hinged doors, composed of two layers of matched boards with building paper between, so as to provide ventilation during the curing period. The door at the south-east corner of the house was remodeled by covering with paper and an extra layer of boards.

III

Sweet Potato Weight Losses in House At Auburn, Alabama

In order to determine the loss in weight of sweet potatoes during the curing and storing periods, 5 hampers of 50 pounds each were selected, washed, and weighed at regular intervals during the curing period and at the end of the storage period. Two packages were discarded in the 1918-19 experiment and one package in 1919-20 because of decayed potatoes. The potatoes in the other seven packages kept without loss in quality or color. In the experiment a No. 1 grade of potatoes was used. Losses in weight during the curing period and at the end of the storage period varied very little.

Table 6—Loss in Weight of Sweet Potatoes Stored in House 1918-1919

DATE	Hamper No. 1* (Lbs.)	Hamper No. 2* (Lbs.)	Hamper No. 3* (Lbs.)
November 8	50.00	50.00	50.00
November 9	49.50	49.48	49.46
November 10	49.27	49.25	49.22
November 11	48.86	48.80	48.82
November 12	48.67	48.65	48.65
November 13	48.35	48.52	48.34
November 14	48.10	48.05	48.10
November 15	47.93	47.86	47.88
November 16	47.85	47.80	47.82
November 17	47.60	47.65	47.55
November 18	47.40	47.55	47.35
Loss during period (11 days).....	5%	4.9%	5%
March 22, 1919.....	44.55	44.90	44.50
Loss during curing and storage periods (4½ months).....	10.9%	10%	11%

*Triumph potatoes used. Average loss 10.7 per cent.

Table 7—Loss in Weight of Sweet Potatoes Stored in House, 1919-1920

DATE	Hamper No. 1* (Lbs.)	Hamper No. 2* (Lbs.)	Hamper No. 3** (Lbs.)	Hamper No. 4** (Lbs.)
November 6	50.00	50.00	50.00	50.00
November 7	49.35	49.65	49.65	47.70
November 8	48.65	49.00	49.00	48.80
November 10	47.35	48.10	48.40	48.00
November 11	47.10	48.05	48.20	47.85
November 12	46.95	47.95	48.10	47.45
November 14	46.50	47.55	47.50	46.90
November 15	46.30	47.50	47.45	46.65
November 27	45.50	46.50	46.35	45.40
Loss during curing period (22 days).....	9%	7%	7.3%	9.2%
May 16-20	43.20	43.55	43.80	43.50
Loss during curing and storage per- iod (6-1½ months).....	13.6%	12.9%	12.9%	13.9%

*Triumph variety used.

**Porto Rico variety used.

Average loss 12.97 per cent.

Reference: Alabama Bulletin 220, Pages 9 and 10, November 1923, "Harvesting and Storing Sweet Potatoes," Agricultural Experiment Station, Auburn, Alabama.

IV

Loss of Weight in Curing at Auburn, Alabama

One hundred and twenty pounds of Triumph potatoes were selected from the field when dug November 10, 1915, placed in the storage house and a careful record kept of their loss in weight.

Table 8—Loss in Weight in Curing Sweet Potatoes at Auburn, Alabama, 1915-1916

Date 1915	Weight in Pounds	Weight Loss	Percent of Loss
November 10	120.		
November 11	118.2	1.8	1.5
November 12	117.	3.	2.5
November 13	116.1	3.9	3.25
November 15	114.5	5.5	4.58
November 16	113.85	6.15	5.12
November 17	113.25	6.75	5.62
November 18	112.86	7.14	5.95
November 19	112.28	7.72	6.43
November 20	111.95	8.05	6.70
November 22	111.25	8.75	7.29
November 23	110.74	9.26	7.71
November 24	110.53	9.47	7.89
November 25	110.16	9.84	8.2
November 26	109.82	10.18	8.48
November 27	109.45	10.55	8.79
November 29	108.85	11.15	9.29
November 30	108.65	11.35	9.45
December 1	108.40	11.60	9.66
December 2	108.20	11.80	9.83
December 3	108.	12.	10.
December 4	107.70	12.30	10.23
December 6	107.20	12.80	10.66
December 7	107.	13.	10.83
December 8	106.85	13.15	10.96
December 9	106.40	13.60	11.33
December 10	106.10	13.90	11.5
December 11	105.80	14.20	11.85
December 13	105.55	14.45	12.04
December 14	105.10	14.90	12.41
December 16	104.80	15.20	12.66
December 20	103.80	16.20	13.5
December 21	103.30	16.70	13.91
December 23	103.15	16.85	14.04
December 24	103.	17.	14.16
December 25	102.85	17.15	14.29
December 27	102.35	17.65	14.7
December 30	102.	18.	15.
1916			
January 1	101.	19.	15.83
January 14	99.	21.	17.66
February 1	95.	25.	19.83
February 14	93.80	26.20	21.83
March 13	90.10	29.90	24.92

A set of standard scales weighing to the one-hundredth of a pound, was used to secure the above data. The package which was of slatted construction, was placed on the scales in the storage room and was not removed until the end of the experiment.

The first five days show a loss of 5.5 pounds moisture with an average tem-

perature of 84°F., while during the next five days under an average temperature of 62°F., there was an additional loss of only 2.22 lbs., or only 40 percent of the rate during the first five days at the higher temperature. Notice chart of November, 1915, when the temperature was low and the humidity high, the loss of moisture was lowest, as shown November 20, 24, 30, December 24, and 27 to 30.

The evaporation of excess water immediately following storage constitutes curing. The rate of evaporation is evidently influenced by the percentage of excess moisture in the potato and also by the temperature and percent of moisture in the air at any time.

Reference: Alabama Agricultural Experiment Station Bulletin 197, pages 94, 95 and 96, Table 3, "Harvesting and Storing Sweet Potatoes," Auburn, Alabama.

V

Sweet Potato Weight Loss in Banks at Auburn, Alabama

One lot of potatoes was selected, numbered, weighed, and placed in a storage bank, November 15, 1918, and another lot was handled in the same way and stored in a bank November 5, 1919. In each case the bank remained closed until the potatoes were taken out and weighed.

During the curing season there were variations of 7 to 29 degrees between top and bottom of bin.*

Table 9—Weight Losses in House and in Bank at Auburn, Alabama

Date Storage Began	Date Storage Ended	Storage Method	% Loss
November 8, 1918	March 22, 1919	House	10.7
November 15, 1918	May 16, 1920	House	12.97
November 15, 1918	March 18, 1919	Bank	4.15
November 5, 1919	April 12, 1920	Bank	6.91

*Temperature readings were taken at top of bin, at floor and half-way between. Averages of 89 temperature readings at each height during the 11 days of the curing period are as follows: At top of bin, 76.9°F., at floor 62.8° F., halfway between, 72.6° F.

Reference: Bulletin 220, page 10-11, November, 1923, "Harvesting and Storing Sweet Potatoes," Agricultural Experiment Station, Auburn, Alabama.

VI

Loss of Moisture in Sweet Potatoes in Storage in Delaware

Nature of These Storage Investigations. In cooperation with the Bureau of Plant Industry of the U. S. Department of Agriculture, a project was undertaken in which accurate data were to be gathered on the relation of moisture, temperature, and ventilation to the storage rots of sweet potatoes.

We placed three hydro-thermographs, one each respectively on the first, second and third floors of this modern large commercial storage house of 30,000 baskets capacity at Seaford, Delaware. This house is equipped throughout with false floors, air spaces between bins, and ventilation between floors. A large top or cupola ventilator is provided. Two wide side aisles and a thirty inch middle aisle give considerable air space around the two rows of bins on each floor. Heating by stoves in the corners, with flues running parallel with the house and along either of the side aisles, offers means for the movement of air between floors through trap doors.

Data Obtained From Moisture Studies. Accurate experiments were planned to learn the amounts of moisture sweet potatoes give off under average bin storage as compared with hamper storage, and at what period in storage this moisture is given off.

It is to be expected that in the more compact storage of sweet potatoes in bins, there will not be the loss of moisture that can take place in basket or hamper storage. To determine the amount of moisture given off in each method of storage, sweet potatoes were weighed as they were placed in bin storage. For comparison sweet potatoes were placed in basket storage in the same house and on the same floors during the season of 1914-15.

Table 10—Bin Storage of Sweet Potatoes in 1914-15, in Delaware, Showing Marketable Potatoes Taken Out, the Amount of Moisture Given Off, and the Losses From Black Rot, Soft Rot, and Dirt

Floor	Bin No.	Date When Put in Storage	Date When Taken Out of Storage	Weight When Put in Storage	Weight of Potatoes Taken Out Including Rots and Dirt Lbs.	Loss of Moisture		Loss From Black Rot		Loss From Soft Rot		Loss Dirt	
						Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%
First	October 8 14	March 1 1914	1915	15,980	14,167	1,813	11.4	1,017	6.4	1,350	8.4	55	.3
Second	October 13 8	March 2 1914	1915	18,100	14,975	3,125	17.3	301	1.7	334	1.8	65	.3
Third	October 15 10	Jan. 9 1915	1915	11,917	10,570	1,377	11.5	512	4.3	384	3.2	64	.5

Table 11—Loss of Moisture in Basket Storage of Sweet Potatoes—Season of 1914-15

Dates Weighed	Oct. 26	Nov. 2	Nov. 9	Nov. 16	Dec. 21	Jan. 4	Feb. 15	Mar. 22	Percent lost as Moisture
Weight 4 baskets	103	102	100	99.5	93.5	92.5	86	82	20.4%
Weight 4 baskets	103	102	96	93.5	92	92.5	86	83.5	18.9%
Weight 4 baskets	105	102	101	100.5	97.5	95	86	81	22.9%

First Floor

Second Floor

Third Floor

Table 12—Loss of Moisture in Hamper Storage of Sweet Potatoes in a Large Commercial Storage House (40x60 feet, three floors) at Seaford, Delaware—Season of 1916-17

Six hampers on each floor filled and weighed October 24, 1916

Dates Weighed	Oct. 24	Nov. 6	Nov. 23	Dec. 11	Jan. 8	Jan. 29	Total Weight lost Oct. 24-Jan. 29
First floor (by stove)							
Total weight (lbs.)	300	280.5	275.75	264.0	255.0	247.5	52.5
Weight lost (%)		6.5	1.6	3.9	3.0	2.5	17.5
Second floor (in alley)							
Total weight (lbs.)	300	285.5	277.5	269.5	263.0	258.0	42.0
Weight lost (%)		4.9	3.0	4.3	2.0	1.6	14.0
Third floor (in alley)							
Total weight (lbs.)	300	284.5	281.25	274.0	267.5	262.5	37.5
Weight lost (%)		5.2	1.1	2.4	2.2	1.6	12.5

Reference: Delaware Experiment Station Bulletin 127, Page 33, Tables 1, 2, 3 and 4 pages 26-33, January 1, 1920. "Sweet Potato Storage in Delaware," Newark, Delaware.

VIII

Effect of Low Temperatures On Cured Sweet Potatoes

To determine whether or not low storage temperature of 1917 could have caused heavy loss, a number of experiments were conducted to find the lowest temperature potatoes dug before frost and properly cured would stand without injury or loss by decay. Lots of 20 selected, cured (Triumph) potatoes were placed in the weather shelter by a thermograph machine and the following observations made:

Table 13—Effect of Low Temperature While in Storage On Keeping Qualities of Sweet Potatoes at Auburn, Alabama 1919-1920

Date	Minimum Temperature	Temperature Potatoes Were Held Under For Given Time	Examined	Condition when Examined
Jan. 2	36° F.	40° F. for 10 hours	May 5	Excellent—sound, juicy, and of good quality
Jan. 3	32° F.	35° F. for 8 hours	May 5	Excellent—sound, juicy, and of good quality
Jan. 5	29½° F.	32° F. for 6 hours	May 5	Good—except for slight injury at cambium
Mar. 6	24° F.	24° F. for 6 hours 32° F. for 15 hours	25 days later	70 percent rotten, and remainder in bad condition
Mar. 7	23° F.	23° F. for 5 hours 32° F. for 12 hours	Two days later	All rotten
Mar. 8	20° F.	20° F. for 1 hour 32° F. for 13 hours	Two days later	All rotten
Mar. 9	27° F.	27° F. for 24 hours 32° F. for 9 hours	May 5	Slight leatheriness and discoloration when cut—All sound

Reference: Alabama Bulletin 220, November 1923, page 8, "Harvesting and Storing Sweet Potatoes," Agricultural Experiment Station, Auburn, Alabama.

VIII

Sweet Potato Curing and Storage Tests at Stoneville Branch Experiment Station, Stoneville, Miss.

This Station has an improvised storage house, made to conform as nearly as possible to the standard house with little expense, in which sweet potatoes keep perfectly. An ordinary heater surrounded by a sheet iron jacket is placed in the center of the house to provide heat. Ventilators are cut at the top and bottom of all four corners to provide air circulation.

The same day digging is begun the house is heated to about 85 degrees F., and kept between 80 and 90 degrees for about 10 days, with doors and ventilators open. When properly cured the potatoes have a spongy feeling.

Table 14—Percent Shrinkage of Various Varieties and Treatments

Variety and Treatment	1927	1928	1929	1930	Average
	Variety Shrinkage in Curing and Storage				
Porto Rico	9.0	2.6	4.4	11.3	6.8
Nancy Hall	6.0	5.9	10.5	24.6	11.8
Triumph	6.0	9.4	7.8	25.4	12.2
Gold Coin	9.0	1.9	8.7	24.0	10.9
Southern Queen	8.0	8.5	4.4	21.5	10.6
Yellow Yam	11.0	6.2	21.4	35.0	18.4
Pumpkin Yam	10.0	13.0	.....	.....	11.5
Bunch Yam	12.0	10.9	.....	.....	11.4
Dooley	11.0	7.6	18.5	.....	12.4
Gold Skin	.....	.....	6.1	24.1	15.1
Yellow Jersey	.....	.....	.....	23.0	.....

Shrinkage of Various Fertilizer Treatments

No fertilizer	10.0	9.4	10.3	9.3	9.8
Sodium nitrate	9.0	8.3	9.8	8.5	8.9
Sodium nitrate and superphosphate	10.0	8.3	9.4	9.3	9.3
Sodium nitrate, superphosphate, and sulphate of potash	9.0	8.5	10.4	8.4	9.1
Superphosphate and sulphate of potash	11.0	8.9	10.6	9.1	9.9
No fertilizer	10.0	9.4	10.3	9.3	9.8
Sodium nitrate and sulphate of potash	.....	.....	9.0	8.3	8.7
Superphosphate	.....	.....	11.1	9.5	10.3

The fertilizer was applied at the rate of 225 pounds nitrate of soda; 225 pounds superphosphate, and 75 pounds sulphate potash per acre, wherever the respective element was used. The 5-row plots were duplicated four times and records kept on the 3 center rows.

Pumpkin Yam, Bunch Yam, and Dooley were dropped from the variety tests in 1930 because of very poor production. Gold Skin, Yellow Jersey, Big Stem Jersey, and Vineland Bush varieties were added in 1930. Big Stem Jersey was such a poor producer and a still poorer keeper that it was dropped in 1931.

The fertilizer test had been planted with Porto Rico. So far the only noticeable difference is a slightly greater shrinkage where superphosphate was used and on the unfertilized plots.

Reference: Service Sheet 78, Delta Branch Experiment Station, Stoneville, Miss., January 21, 1932.

Mr. Hunter Thompson, of Longview, Mississippi, reports having stored 450 hampers of well graded potatoes in a curing house in the fall of 1931. From these 450 hampers, he repacked 405 hampers in the spring of 1932, having a shrinkage of 45 hampers, or 10%.

IX

Experiments in Handling and Storing Sweet Potatoes in Virginia

The office of Horticultural and Pomological Investigations of the Bureau of Plant Industry, U. S. D. A. began a study in 1912 on sweet potato storage. This study was conducted in the southern states and was continued through 1921. During the first four years, 1912-1916, the experiments were not entirely under the control of the investigators since they were conducted in houses owned and controlled by farmers or commercial firms. During the last five years, 1916-17 to 1920-21, the work was under complete control of the investigators and was conducted in a storage house erected for this purpose on the Arlington Experimental Farm at Rosslyn, Virginia.

All the potatoes were subjected to curing process for a period of two or three weeks.

Five tests were made to compare careful handling in the field and storage house with commercial handling. Table 15 gives the results of these tests for the period 1912-1916 inclusive.

Table 15—Effects of Methods of Handling on the Keeping Quality of Sweet Potatoes, Four-Year Average

Variety	Careful Handling				Commercial Handling			
	Wt. at Harvest Time Lbs.	Days in Storage	Percent Shrinkage	Percent Loss By Decay	Wt. at Harvest Time Lbs.	Days in Storage	Percent Shrinking	Percent Loss By Decay
Nancy Hall	3,062	161	5.00	.50	3,062	161	7.40	1.00
Dooley	120	125	9.10	.93	120	125	11.60	2.08
Nancy Hall	45	125	9.39	5.56	45	125	20.40	15.56
Dooley	42	131	8.33	2.00	42	131	10.70	5.00
Nancy Hall	9,510	114	8.30	.41	110,663	114	10.10	3.04
Total	12,799				113,932			
Average		131	7.52	.45		131	10.00	3.00

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Several experiments were conducted from 1913 to 1916 to compare the keeping quality of sweet potatoes in storage houses with that of those kept in outdoor banks or pits.

Results are given in Table 16.

Table 16—Effects of Methods of Storage on Keeping Quality of Sweet Potatoes, Three-year Average

Variety	Storage House			Banks or Pits		
	Days in Storage	Weight at Harvest, lb.	Percent Loss by Decay	Days in Storage	Weight at Harvest, lb.	Percent Loss by Decay
Triumph	137	6,000	.60	1913-14 124	42,000	10.00
Nancy Hall	106	84,000	.60	1914-15 106	4,500	17.30
Nancy Hall	118	48,000	1.50	1915-16 102	18,000	33.30
Nancy Hall	103	90,000	2.00	103	30,000	11.60
Triumph	115	372,000	1.50	108	12,000	7.30
Nancy Hall	110	168,000	.60	110	6,000	6.50
Nancy Hall	123	120,000	.50	120	1,800	6.40
Mixed varieties	114	48,000	1.00	114	60,000	4.00
Nancy Hall	110	48,000	1.75	110	18,000	35.00
Nancy Hall				110	12,000	40.00
Total		984,000			204,300	
Average	115		1.20	111		14.33

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A test to determine the effects of cutting and bruising in shrinkage and decay in storage was conducted at the Arlington Experimental Farm. Potatoes injured at digging time were compared with uninjured potatoes of the same varieties. Three standard varieties were used and all potatoes were kept under like conditions.

Table 17 shows the results of these experiments.

Table 17—Effects of Cutting and Bruising on Shrinkage and Decay of Sweet Potatoes in Storage

Variety	Average Weight at Harvest Time Lb.	Weight at end of Storage Period Lb.	Shrinkage During Curing 19 days, Per cent	Shrinkage at end of 164 days, Per cent	Loss Due to Decay, 164 Days	
					Pounds	Percent
Uninjured						
Big Stem Jersey	142.56	123.25	6.59	13.54	1.81	1.27
Nancy Hall	140.00	121.56	7.14	13.10	.84	.60
Southern Queen	153.09	130.59	7.83	14.69	.59	.38
Total	435.66	375.41	.....	.....	3.25	.....
Average	.....	.....	7.23	13.83	.....	.75
Injured, cut, and bruised						
Big Stem Jersey	73.25	48.47	14.44	33.83	20.16	27.52
Nancy Hall	46.06	32.47	18.52	29.51	4.28	9.29
Southern Queen	71.97	56.53	12.55	21.88	1.94	2.69
Total	191.28	137.47			26.38	
Average			14.83	28.13		13.79

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Reference: Agricultural Education Volume 10, No. 9, pages 142, 143 and 144, tables 13, 14 and 15, Clemson College, South Carolina.

2. Effect of Fertilizers On Curing Results

Is there any appreciable difference in the keeping qualities of sweet potatoes from various fertilizer treatments? What fertilizers show the lower rot percentages? Which fertilizers give the higher net yields of sound cured potatoes?

I

Effect of Fertilizers on Storage of Sweet Potatoes at Experiment, Georgia

A considerable part of the work with sweet potatoes necessitated the keeping of the seed stock over winter, consequently we had to look more carefully into the keeping of the crop before we could prosecute successfully certain phases of our experimental work.

During the summer of 1914, we remodeled a shed on the Station grounds into a storage house for sweet potatoes. The shed was twenty-five feet long and fourteen feet wide. It was ceiled with lumber, and made as near air tight as practicable with building paper. A line of ventilators was put in the side of the building, near the ground, and others were placed in the ceiling. Dead air space was left between the inner and outer walls. An ordinary coal burning heater was placed in a shallow pit in one end of the building, and an 18 inch trench leading from this pit was dug the entire length of the building. The smoke pipe from the heater was placed in this trench and extended up through the roof at the opposite end of the building. The slatted bins for holding the potatoes were constructed over the trench so as to allow the heat to come up through them to cure the potatoes. A concrete floor was placed in the building to prevent entrance of rats and to keep down an excess of moisture.

Table 18—Influence of Fertilizers on the Keeping Qualities of Sweet Potatoes on Cecil Clay Loam at Experiment, Georgia

Plot No.	Fertilizer Applied Per Acre	Percent Kept Sound in Storage					Average Percent Kept Sound	Av. Yield Per A., 12 Yrs. 1908-1919 (Bus.)
		1914-15	1915-16	1916-17	1917-18	1918-19		
1	24 tons stable manure	74.2	82.0	84.0	50.0	66.9	71.4	237
2	2100 pounds acid phosphate	62.3	80.9	98.0	66.0	83.2	78.0	189
3	900 pounds sulphate of potash	83.6	86.4	96.7	85.1	90.6	88.4	204
4	1500 pounds nitrate of soda	88.8	88.2	93.0	80.0	86.4	87.2	181
5	1800 pounds complete fertilizer	90.6	85.7	95.0*	40.0	71.5	76.5	252
6	Check-no fertilizer	96.3	88.1	97.0	88.1	88.5	91.6	167

Size of plots—1/30 acre.

Variety of sweet potatoes—Myers Early, a yellow or yam type, resembling very closely the Nancy Hall.

The potatoes from the different plats, were kept in separate bins in the storage house each winter of the five years. The potatoes from each plat were used as seed stock to plant the same plat the following season; i. e. potatoes from plat one were used to produce plants for plat one the following season.

The lack of constancy may be due, in part, to black rot infection, being greater in certain plats and bins from year to year. The continuous planting of potatoes on the same soil for several years produced conditions favorable to the development of black rot, which make accurate data in connection with fertilizing and storage investigations more difficult to secure.

Reference: Georgia Experiment Station Bulletin 134, page 84, December, 1919, "Further Studies in Fertilizing and Storing Sweet Potatoes," Experiment, Georgia.

Table 19—Loss of Weight of Sweet Potatoes in Storage at Experiment, Georgia

A definite quantity was weighed out of each plot of the 1915 sweet potato crop, on November 13 and placed in the storage bins. These potatoes were carefully

selected and so handled that no decay took place further than a few small specks of black rot on the specimens from plot two. The first of the following March, the potatoes were reweighed with the following percentages in loss of weight:

Plot No.	Fertilizer Applied Per Acre	Percent Loss of Weight
1	24 tons stable manure.....	17.7
2	2100 pounds acid phosphate (16%).....	21.5
3	900 pounds sulphate of potash.....	17.2
4	1500 pounds nitrate of soda.....	17.7
5	1800 pounds complete fertilizer.....	13.4
6	Check - no fertilizer.....	12.1
	AVERAGE.....	16.6

Variety of sweet potatoes: Myers Early, a yellow or yam type, very closely resembling the Nancy Hall.

Reference: Georgia Bulletin 134, December 1919, page 85, "Further Studies in Fertilizing and Storing Sweet Potatoes," Georgia Experiment Station, Experiment, Georgia.

II

Table 20—Effect of Various Potash Fertilizers On Keeping Qualities of Sweet Potatoes in Delaware

Plot	Treatment 1500 Lbs. Per Acre	1929				1930				AVERAGE			Yield Per Acre 2 Years
		Potash Source	% Shrink- age	% Rots	% Market- able	% Shrink- age	% Rots	% Market- able	% Shrink- age	% Rots	% Market- able		
1	3-8-8	Check	....	....	....	19.8	10.3	69.9	....	....	....	259	
2	3-8-8	KCl	....	....	....	19.8	11.3	66.8	....	....	....	269	
3	3-8-8	K ₂ SO ₄	....	....	....	21.9	12.5	66.7	....	....	....	258	
4	3-8-8	M. S.	6.6	4.5	88.9	16.8	49.1	43.1	11.7	22.3	66.0	229	
5	3-8-8	Kainit	14.7	1.8	83.5	25.2	57.4	17.4	20.0	29.6	50.5	255	
6	3-8-8	Check	15.2	2.1	82.7	20.0	43.9	36.1	17.6	32.0	59.4	355	
7	3-8-10	KCl	14.3	18.6	67.1	16.0	46.9	37.1	15.2	32.8	52.1	309	
8	3-8-10	K ₂ SO ₄	17.5	6.2	76.3	17.7	46.9	50.2	17.6	19.2	63.3	255	
9	3-8-10	M. S.	14.3	23.2	62.5	20.8	26.9	52.3	17.6	25.1	57.4	309	
10	3-8-10	Kainit	19.0	13.8	67.2	24.6	42.2	33.2	21.8	28.0	50.2	291	
11	3-8-10	Check	15.0	17.3	67.7	20.2	17.3	62.5	17.6	17.3	65.1	265	
12	3-8-12	KCl	16.4	3.0	80.6	20.8	35.7	42.5	18.6	19.4	62.1	293	
13	3-8-12	K ₂ SO ₄	16.3	2.6	81.0	19.6	7.7	72.7	18.0	5.2	76.9	260	
14	3-8-12	M. S.	14.0	....	86.0	21.1	68.1	10.8	17.6	34.1	48.4	200	
15	3-8-12	Kainit	15.9	6.4	77.7	19.1	38.2	42.7	17.5	22.3	60.2	178	
16	3-8-8	Check	12.3	13.8	73.9	19.5	26.7	53.8	15.9	20.3	63.9	....	
17	3-8-14	KCl	13.7	....	86.3	19.1	19.8	61.1	16.4	9.9	73.7	279	
18	3-8-14	K ₂ SO ₄	12.2	....	87.8	14.1	22.5	63.4	13.2	11.3	75.6	281	
19	3-8-14	M. S.	13.1	7.2	79.6	22.4	72.9	4.7	17.8	40.1	42.2	256	
20	3-8-14	Kainit	15.3	5.8	78.8	23.6	32.1	44.3	19.5	19.0	61.6	209	
21	3-8-8	Ammo	19.6	35.2	45.2	18.6	31.6	49.8	19.1	33.4	47.5	302	
22	3-8-8	Check	17.6	30.3	51.5	21.3	24.6	54.1	19.5	27.7	52.8	277	
Average plots 1, 6, 11, 16, 22													

KCl—Muriate of Potash.
K₂SO₄—Sulphate of Potash
M.S.—Manure Salts

K—Kainit
Ammo—Amorphoska

Averages For Various Potash Sources

Potash Source	1929			1930			AVERAGE			Average Production Two Years 1929-1930
	Shrink- age %	Rots %	Market- able %	Shrink- age %	Rots %	Market- able %	Shrink- age %	Rots %	Market- able %	
KCl	14.8	7.2	75. *	19.4	28.4	52.1	16.7	20.7	62.	29.9
K ₂ SO ₄	15.0	2.9	81.7 *	23.0	18.7	50.7	16.3	11.9	71.9	27.6
M. S.	12.0	8.7	79.0	20.3	52.0	27.7	16.2	30.4	53.0	27.1
Kainit	16.2	6.9	76.8	23.1	42.5	34.4	19.7	24.7	55.6	20.4
Check	15.0	16.0	68.9 *	20.2	24.6	55.3	17.6	22.1	60.3	.....

* Average of 3-8-10 and 3-8-12 plots only.

** Average of only three plots.

Sweet Potato Storage: Since most Delaware sweet potatoes are held in storage for a later market, a study was made as to the keeping qualities of these sweet potatoes produced by different fertilizers. Two baskets were stored from each plot immediately after harvest and held at a temperature of 80-85 degrees F. for two weeks and then 55 to 65 degrees until the last week of January. They were weighed when placed in storage and again when removed. They were also examined for rots and these were weighed separately upon removal from storage.

These percentages are based upon the weight of the potatoes when placed in storage. The rots consist principally of surface rot, black rot, and soft rot, and their prevalence was in the order named.

These tests are located at Delmar on Sassafras sandy loam soil, deep phase. A comparison of the varying percentages and sources of potassium is being made on these plots. A 3-8-8 fertilizer made up of $\frac{1}{2}$ the nitrogen derived from nitrate of soda and $\frac{1}{2}$ from sulphate of ammonia, superphosphate and muriate of potash is used as a standard treatment on the check plots. Diamphos (21% N, 53.4% phos. acid) is used as a base and the various percentages and sources of potash added to make the desired analysis. On plot 21 ammophoska (12-24-12) is used. Superphosphate and muriate of potash and filler were added to make a 3-8-8 and applied at the same rate as the other plots. Two to three weeks prior to planting time all fertilizers are drilled broadcast at the rate of 1500 lbs. per acre.

The 1929 season was considered a normal year and satisfactory yields were obtained. The 1930 season was not normal because of the extreme drought and much lower yields were obtained.

Reference: Bulletin 172, pages 16, 18 and 19, "Annual Report of Director," November, 1931, University of Delaware Agriculture Experiment Station, Newark, Delaware.

3. Value of Fungicides in Preventing Sweet Potato Decay

At Experiment, Georgia in November, 1910, 110 pounds of Nancy Hall sweet potatoes were treated for thirty minutes with a solution made by adding one pint of formalin to forty gallons of water. The potatoes were then taken out and allowed to dry. These potatoes and 110 pounds of potatoes that had not been treated were hilled in the same manner. On the following March 14th the hills were opened with the following results:

Seventy-four per cent of the potatoes treated with the formaldehyde solution kept.

Eighty-five per cent of the untreated potatoes kept.

The following year the potatoes were again treated by immersing them in 5-5-50 Bordeaux mixture and dried before hilling. The same quantity of untreated potatoes was hilled in the same way and at the same time as the treated potatoes.

However, when the hills were opened in the spring there was practically no difference in the percentage of rot in the two hills.

No further experiments were made along this line.

Reference: Georgia Agricultural Experiment Station Bulletin 107, page 63, March 1914, "Sweet Potatoes, Culture, Storing and Studies in Fertilizing," Experiment, Georgia.

4. Storage Houses

I

A New Type of Storage House

For the past thirty years sweet potatoes have been stored in houses. The writer, in 1917, at the Alabama Experiment Station, in Bulletin No. 197, discussed at length the storage of sweet potatoes in houses as compared with banks. There have been various types of houses recommended. For the past several years experiments have been conducted here* in an effort to improve on potato houses formerly recommended. The old types of houses, with stove in the curing room, were objectionable because the stove occupied much space which might have been used for potatoes, and the curing was not uniform due to poor circulation of heat and insufficient ventilation overhead. In this type house, the temperature near the ceiling will often range from 90 to 100 degrees Fahrenheit, and near the floor the temperature will be from 60 to 70 degrees Fahrenheit. Potatoes cure very slowly at temperatures as low as the floor temperature mentioned above.

The main feature of the improved house which has been worked out here is the basement in which the stove is placed. The basement is made with brick foundation and cement floor. This type of foundation keeps the house much warmer during the cold winter than does the house resting upon pillars. Heat from the stove, placed in the center of the basement, travels upward, passing through a slatted floor, on through the potatoes, and cures them uniformly. The chimney or flue extends up through the storage room near center of room at side of aisle. Careful tests with thermometers indicate that the temperature at the floor in the center of the room and at the ceiling does not vary more than a degree or two, as compared with a difference from 20 to 30 degrees when the stove is placed in the curing room.

Another change from the old type of curing house is the false or slatted floor under the bins—the floor in the aisles is tightly built. The old type of houses had a double floor. The new floor is obviously less expensive. The floor is constructed of 1½" x 8" timbers, with one inch space between. Another change is in the placing of the bins. The new idea is to place them four inches from the walls and four inches from each other. This permits air to pass between walls and bins, carrying out moisture.

In the new type of house a larger overhead ventilator is used than in the old type. Instead of the 10" x 10" ventilator, a 24" x 24" one is used, and is more satisfactory. The new type of house is more tightly built than others, and this keeps the temperature more constant than in more loosely built houses. During the past winter, which was a severe one, no fire was built during the entire winter, and at no time was the temperature below 50 degrees Fahrenheit. There are no windows in the new house, just a door of refrigerator type on either side, at the end of the aisles. These are kept open during curing, and create a current of air through the house, facilitating removal of excess moisture; they also make loading and unloading very convenient.

The house is built according to government plans, with tight walls and an air space between. The outer walls are of No. 1 weather boarding, lined with building paper. A four-inch air space is left, then another wall of matched boards, with building paper on it, and the paper in turn covered with a wall of tongued and grooved flooring. A house 20' x 20' should have at least four bins on either side of

*At Mississippi State College.

the aisle. Some prefer the bins a little narrower as they think better curing is obtained thereby. Narrow bins are troublesome to fill, and it is difficult to pack and grade potatoes when getting them out for selling or other purposes. In the new type of house bins are filled to within two feet of the ceiling and good results are obtained. It is practically impossible to fill the bins fuller than this without having to lay them in with the hands. Unless crowded for space, it is better to leave 2½ feet of space at the top of the bins.

The advantages of the new over the old type houses are: The storage space in the room is about 20% greater since stove is not in the way; potatoes are subject to the same heat throughout the room; filling may be done one bin at the time or in the several bins, as is recommended for the old type of house; there is a minimum loss in the new type of house provided potatoes are properly handled when placed in storage. The basement may be used for storage. Hampers may be removed from the curing room above to the basement after being cured, and will keep as if in the curing room, however, curing in the basement is subject to all the disadvantages of the old style house with stove in curing room.

Reference: Mississippi Agricultural Experiment Station Bulletin 279, pages 13, 14, 15, and 16, August 1930. "The Production and Storage of Sweet Potatoes," State College, Mississippi.

II

Tests of A Commercial Sweet Potato Storage House at Melfa, Virginia, 1927-28

Description of House: The building is 45x100 feet and consists of three floors, with a total capacity of 10,000 barrels. The two upper floors, each divided into two rooms of equal size are used for storage of sweet potatoes, while the first floor is used for white potatoes.

The walls are 12 inch cinder blocks for first floor and 8 inch blocks for the upper stories. Pilasters of the same material are used to stiffen the walls and support the heavy loads. Steel columns and guides support the wood floor and joists while wood posts support the roof.

The roof consists of 2" x 6' rafters carrying 1 inch matched sheathing, ½ inch of commercial insulated board, a second layer of 1 inch matched sheathing and over this a heavy unsurfaced prepared roll roofing.

A ventilating system, together with a heating system, provides control of temperature and moisture within the building.

Air is admitted to the upper stories through small ports just below the floor line.

Two air out-take flues each 4 feet square extend from the ceiling of the first and second stories through the roof and are capped with 36 inch metal ventilators.

The third story is vented directly into four 36-inch ventilators.

Tight construction is essential.

Heating Equipment. The upper floors are heated by means of a steam boiler and pipe coil radiators immediately above the air ducts.

Four hundred barrels of table stock, mostly Little Stem Jersey varieties were obtained from selected fields of local growers, the condition with respect to disease infection being noted. Twenty barrels of each lot were placed at each of five stations in each room. Table 21 shows the average temperature and humidity.

Table 21—Results of Instrument Readings Inside and Outside the Storage House

Room	Average Temperature and Humidity During Curing Period				
	Average Temperature		Relative Humidity		Curing Period
	Out	In	Out	In	
	Degrees	Degrees	Percent	Percent	Days
A	60.7	75.1	69.0	64.8	8
B	63.0	84.5	69.8	63.7	6
C	58.0	79.2	68.8	62.3	6
D	58.0	80.9	68.8	63.4	6

Table 22—Moisture Loss From Hampers

Room	Average Curing Temperature	Average Weights			Loss	Relation	
		In	Out			Curing to Total	
	Degrees	Pounds	Pounds	Pounds		%	%
A	75.1	52.2	44.7	7.5		14.4	32.0
B	84.5	50.8	45.0	5.3		10.5	32.0
C	79.2	51.1	45.0	6.1		11.9	41.0
D	80.9	50.8	46.0	3.8		9.4	45.8

Table 23—Average Percent Shrinkage Per Barrel

Room	Owner No.				Weighted Average
	2	7	8	28	
A	9.37	7.57	8.84	8.26	8.51
B	8.06	6.76	5.76	6.51	6.77
C	7.01	5.32	7.02	8.33	6.92
D	6.42	4.85	6.01	6.97	6.06

Reference: Agricultural Engineering, Vol. II, (May 1930) No. 5, pages 181-184, by M. A. R. Kelley, Agricultural Engineer, U. S. Dept. of Agriculture.

III

Electric Heat For Curing and Storing Sweet Potatoes in Virginia

In attempting to find some method of heating a sweet potato curing house to obtain a more uniform cure and prevent the usual loss of potatoes, a farmer near Suffolk, Virginia suggested using electric heaters, placing them on the floor under the stored potatoes.

Three sweet potato curing houses used electric heat for curing sweet potatoes in 1932.

The following is a summary of the details for the three houses:

Table 23

House	Bushels Stored	Construction	Connected Load, Kw.	Curing Period	Storage Period
No. 1.....	700	Wood	5.2	10 days	6 months
No. 2.....	2500	Cinder block	8.0	16 days	4 ½ months
No. 3.....	1600	Wood	8.0	14 days	7 months

House	Total KWH Used	Stove Used	Losses Percent
No. 1.....	1108	10 days (curing)	0
No. 2.....	3110	1 day (shipping)	1.8
No. 3.....	8677	14 days (curing)	0

House No. 1.

Located near Suffolk, Virginia, 14x18 feet and with a capacity of 700 bushels wood constructed with insulated walls and ceiling. Crates were racked on a false floor leaving an air space of 8 inches between floor of house and potatoes.

Twelve Street car heaters were connected in series and distributed over the floor and were operated on 220 volts, each heater having an output of 440 watts. A wood stove was used during curing period to reduce cost of curing.

House No. 2.

Located near Norfolk, Virginia and is built of cinder blocks. It is 20x40 feet and has a capacity of 2000 bushels of potatoes in crates, or 2500 in bulk. This year they were stored in bulk in bins. The false floor was 8 inches above the floor. Sixteen 500 watt electric strip heaters were connected in parallel on 220 volts.

Weather conditions were very bad during the curing period. The potatoes were stored wet.

About 2 percent of the potatoes were lost due to over heating directly over the heaters.

House No. 3.

Same design and construction as house No. 2, except wood instead of cinder blocks were used in its construction.

Located on Virginia State Farm near Richmond.

The capacity was the same as house No. 2, however, only 1600 bushels were raised and stored.

Sixteen 500 watt strip heaters were operated and arranged the same as in house No. 2. In addition a wood stove was used during the 14 day curing period.

Reference: Agricultural Engineering, Vol. 14, No. 11, November 1933, pages 305 and 306, by E. T. Swink, Agricultural Engineer, Virginia Electric & Power Company.

For other information on storage houses, see explanation in connection with Table 5.

C. SWEET POTATO ECONOMICS

1. Production by Counties in Mississippi.

Table 24—Acreage and Production of Sweet Potatoes in Mississippi by Counties According to 1930 and 1935 Census Data

County	Acreage		Production (Bushels)	
	1934	1929	1934	1929
Adams	1,068	836	73,728	82,253
Alcorn	649	328	52,652	35,380
Amite	1,726	1,360	158,893	150,962
Attala	1,302	673	136,821	86,454
Benton	254	167	20,512	19,051
Bolivar	1,504	288	102,083	26,760
Calhoun	846	814	90,671	97,616
Carroll	1,301	694	105,733	87,918
Choctaw	1,291	971	141,688	143,415
Chickasaw	1,037	572	94,039	62,432
Claiborne	748	351	89,863	45,492
Clarke	1,563	1,096	129,628	110,365
Clay	729	179	50,123	20,061
Coahoma	1,079	107	79,201	7,913
Copiah	2,470	1,193	247,601	145,902
Covington	1,539	931	148,632	111,222
DeSoto	761	342	62,367	27,269
Forrest	884	584	77,377	64,154
Franklin	840	587	91,734	66,490
George	958	729	74,737	70,303
Greene	945	814	73,259	67,535
Grenada	686	248	60,439	26,401
Hancock	691	495	44,266	49,340
Harrison	675	531	56,201	60,474
Hinds	3,219	2,073	316,810	233,289
Holmes	1,766	880	162,943	81,685
Humphreys	1,163	120	111,120	14,558
Issaquena	181	56	22,635	4,410
Itawamba	1,117	612	98,169	64,216
Jackson	546	335	52,481	37,461
Jasper	1,617	1,079	141,080	122,078
Jefferson	1,053	646	105,605	87,394
Jefferson Davis	1,668	881	182,816	107,575
Jones	2,656	1,592	238,030	194,027
Kemper	1,664	918	130,461	104,534
LaFayette	1,126	437	94,674	50,674
Lamar	1,218	748	123,682	83,979
Lauderdale	2,218	1,494	186,696	142,820
Lawrence	1,120	538	119,846	81,781
Leake	1,080	747	130,330	95,446
Lee	1,083	462	96,639	49,445
Leflore	1,765	365	173,044	38,752
Lincoln	1,918	915	205,226	105,816
Lowndes	1,380	480	102,636	49,053
Madison	2,969	1,276	226,387	131,481
Marion	1,868	1,083	155,833	128,044
Marshall	1,140	491	81,564	56,467
Monroe	1,887	1,036	163,815	129,375
Montgomery	642	336	70,560	43,023

County	Acreage		Production (Bushels)	
	1934	1929	1934	1929
Neshoba	1,499	894	116,347	136,773
Newton	1,514	907	153,591	126,972
Noxubee	1,735	539	119,933	65,874
Oktibbeha	1,659	467	125,522	53,530
Panola	1,400	311	110,455	32,168
Pearl River	1,710	1,468	146,904	142,847
Perry	1,121	706	84,053	76,027
Pike	1,824	964	176,922	110,693
Pontotoc	682	592	60,800	66,502
Prentiss	542	285	49,959	33,246
Quitman	675	66	68,345	8,587
Rankin	1,575	899	178,246	106,762
Scott	1,092	645	138,522	102,631
Sharkey	504	24	48,086	4,032
Simpson	1,675	1,174	169,790	154,905
Smith	1,645	961	162,233	142,640
Stone	810	656	64,022	45,922
Sunflower	2,202	328	251,739	44,886
Tallahatchie	891	385	98,130	37,907
Tate	573	175	40,758	15,181
Tippah	559	457	44,022	48,824
Tishomingo	700	331	58,452	57,745
Tunica	403	13	28,168	1,070
Union	829	363	82,638	44,360
Walthall	7,793	576	224,261	84,690
Warren	665	434	55,729	39,279
Washington	1,445	179	128,888	20,142
Wayne	1,398	854	121,215	99,279
Webster	670	380	66,046	44,978
Wilkinson	1,290	1,061	117,783	98,033
Winston	1,421	763	143,879	91,234
Yalobusha	642	449	54,399	42,273
Yazoo	1,774	118	176,674	78,660
TOTAL	101,000	52,527	9,471,345	6,161,207

Reference: Farm Census, Preliminary Report, Department of Commerce, Bureau of the Census, Washington, D. C.

2. Shipments from Mississippi.

I

**Table 25—Mississippi Points from Which Sweet Potatoes Were Shipped
During the Years 1928-1933**

County and Station	1928	1929	1930	1931	1932	1933
Adams:						
Stanton	9	46	30	46	12	19
Other Stations	1	....	....	....	....	....
Calhoun:						
Vardaman	28	11	11	3	....	....
Other Stations	2	1	....	....	....	....
Chickasaw:						
Houston	20	11	11	1	....	....
Other Stations	....	....	1	1	....	....
Choctaw:						
Ackerman	6	15	44	47	17	7
Weir	13	12	33	19	8*	3*
Lee:						
Shannon	10	8	13	6	....	....
Other Stations	....	....	1	5	....	....
Marion:						
Rokomo	0	13	33	4	....	....
Other Stations	0	2	2	0	....	....
Monroe	4	11	9	13	....	....
Tippah	0	21	....	....	....	....
Wilkinson:						
Centerville	15	22	....	....	....	....
Other Counties	43	41	62	56	20	16
TOTAL	151	214	250	201	67	45

*Other stations than Ackerman.

II

Table 26—Car-Lot Shipments of Sweet Potatoes from Mississippi by Months

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct	Nov.	Dec.	Total
1929	23	18	28	19	3	.....	5	61	5	9	29	14	214
1930	19	26	78	20	5	.....	2	31	15	19	27	8	250
1931	34	50	28	5	.....	.....	2	67	6	1	7	1	201
1932	2	4	21	17	5	1	8	7	.....	.....	2	.....	67
1933													
1934													
1935													

Total Car-Lot Shipments of Sweet Potatoes from all States by Months

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct	Nov.	Dec.	Total
1929	1615	1243	1204	923	660	434	748	1914	4024	3850	2898	2290	21,803
1930	1897	1544	1502	928	444	115	415	1605	2633	3472	2522	1968	19,045
1931	1404	1127	1074	677	313	136	455	1577	2685	2793	2190	1822	16,253
1932	1234	1247	1215	827	500	256	354	1150	1708	1775	1715	1276	13,257
1933													
1934													
1935													

Reference: U. S. Department of Agriculture Statistical Bulletin 38, table 16, page 17, July 1932, "Car-Lot Shipments and Unloads of Important Fruits and Vegetables, for the Calendar Years 1929 and 1930," and Statistical Bulletin 46, table 16, page 15, May 1934, "Car-Lot Shipments and Unloads of Important Fruits and Vegetables for the Calendar Years 1931 and 1932," Washington, D. C.

III

Table 27—Sweet Potatoes: Total Car-Lot Shipments by States, 1929-35

STATE	1929	1930	1931	1932	1935
Alabama	618	341	365	158	362
Arkansas	272	199	108	123	82
California	796	789	656	549	561
Delaware	1547	1266	882	1151	659
Florida	111	132	172	73	92
Georgia	407	457	395	126	83
Illinois	140	169	195	260	23
Indiana	345	384	333	479	85
Iowa	20	18	13	16	9
Kansas	68	77	43	73	2
Kentucky	195	273	290	459	164
Louisiana	1456	1216	1207	1153	2527
Maryland	1869	1313	784	603	429
Mississippi	214	250	201	67	144
Missouri	6	2	11	3	
New Jersey	1146	1096	1262	1126	1158
New Mexico	58	83	130	129	45
North Carolina	598	845	797	562	493
Oklahoma	191	94	37	24	43
South Carolina	213	379	233	80	92
Tennessee	3640	3535	2696	2165	1638
Texas	830	677	518	552	129
Virginia	7062	5449	4924	3326	2322
TOTAL*	21803	19045	16253	13257	

*Figures in column will not total as shown here, some states omitted due to small shipments.

References: United States Department of Agriculture Statistical Bulletins 38 and 46, "Car-Lot Shipments and Unloads of Important Fruits and Vegetables," Washington, D. C.

IV

**Table 28—Total Car-Lot Unloads of Sweet Potatoes at Various Cities
From Mississippi—1929-1935**

MISSISSIPPI								
City	1929	1930	1931	1932	1933	1934	1935	Total
Atlanta, Georgia	2	2	2	18	....	....	....	24
Birmingham, Alabama .....	....	4	9	12	....	....	....	25
Boston, Massachusetts	1	2	....	....	....	....	....	3
Chicago, Illinois	34	50	27	2	....	14	36	163
Cincinnati, Ohio	9	8	11	1	1	6	20	56
Cleveland, Ohio	6	5	8	....	1	1	4	25
Columbus, Ohio .....	....	7	5	....	....	....	6	18
Detroit, Michigan	26	29	32	5	8	12	24	136
Indianapolis, Indiana	5	....	7	....	....	....	1	13
Los Angeles, Calif.	2	27	3	2	1	....	1	36
Louisville, Kentucky	1	2	11	....	....	1	....	15
Memphis, Tennessee	2	11	3	....	....	....	1	17
New York, New York	3	2	10	....	....	....	1	16
St. Louis, Missouri	14	17	11	4	1	6	1	54
San Francisco, Calif. ....	....	4	1	....	....	1	4	14
TOTAL	105	170	140	44	12	41	99	615

1933—2 carloads to Denver.

1934—1 carload to Des Moines, 1 to Grand Rapids, 7 to Kansas City, 2 to Omaha, 1 to Philadelphia and 2 to Pittsburgh.

Reference: U. S. D. A. Statistical Bulletin 38, "Car-lot Shipments and Unloads of Important Fruits and Vegetables 1929 and 1930; and U. S. D. A. Statistical Bulletin 46, "Car-lot Shipments and Unloads of Important Fruits and Vegetables, 1931-1932," and Mimeographed sheet from United States Department of Agriculture, Bureau of Agricultural Economics, Washington, D. C.

L. C. L.* price per bushel on the wholesale market.

3. Price Per Bushel

I

**Table 29—Mississippi and Tennessee Shipments of Sweet Potatoes
To Cincinnati, Ohio**

L. C. L. price per bushel on the wholesale market.

Tenn. Nancy Halls 1934		Miss. Nancy Halls 1934		Tenn. Nancy Halls 1935		Miss. Nancy Halls 1935	
Jan. 2-	\$1.35-\$1.40	Jan. ....	.....	Jan. 2-	\$1.10-1.15	Jan. ....	.....
Jan. 9-	1.25- 1.25	.....	.....	Jan. 9-	1.00-1.10	.....	.....
Jan. 15-	1.15- 1.25	.....	.....	Jan. 15-	.90-1.00	.....	.....
Jan. 22-	1.25- 1.35	.....	.....	Jan. 21-	.85-1.05	.....	.....
Jan. 27-	1.30- 1.40	.....	.....	Jan. 28-	1.15-1.15	.....	.....
Jan. 31-	1.15- 1.40	.....	.....	Jan. 31-	1.10-1.15	.....	.....
July 11- /	2.15- 2.15	July .....	.....	July 1- /	.75- .75	.....	.....
.....	.....	.....	.....	July 6- /	.60- .75	.....	.....
.....	.....	.....	.....	July 12- /	.50- .60	.....	.....
.....	.....	.....	.....	July 20- /	.50- .65	July 23-	\$1.75-1.85
.....	.....	.....	.....	July 24- /	.50- .60	July 26-	1.50-1.50
.....	.....	.....	.....	July 30- /	.60- .60	July 31-	1.25-1.25
Aug. 10-	\$2.05-\$2.15	Aug. ....	.....	Aug. 21-	1.35-1.35	Aug. 1-	1.25-1.25
Aug. 15-	1.75- 1.75	.....	.....	Aug. 24-	1.20-1.25	Aug. 10-	1.15-1.25
Aug. 18-	1.60- 1.60	.....	.....	Aug. 27-	1.00-1.15	Aug. 14-	1.05-1.10
Aug. 24-	1.70- 1.75	.....	.....	Aug. 31-	.90- .95	Aug. 19-	1.25-1.25
Tenn. Nancy Halls 1936		Miss. Nancy Halls 1936		Miss. Puerto Ricans 1936			
Jan. 2-	\$0.85-\$0.95	Jan. ....	.....	Jan. 2-	\$1.15-1.15		
Jan. 9-	.85- .90	.....	.....	Jan. 13-	1.25-1.25		
Jan. 15-	.85- .85	.....	.....	Jan. 14-	1.15-1.25		
Jan. 21-	.80- .90	.....	.....	Jan. 15-	1.15-1.15		
Jan. 28-	.90- 1.00	.....	.....	Jan. 16-	1.10-1.15		
Jan. 31-	.90- .90	.....	.....	Jan. 17-	1.10-1.15		

*Less than Car Lot.

/Old Stock.

Reference: Harold J. Clay, Associate Marketing Specialist.

Fruit and Vegetable Division, U. S. Bureau of Agricultural Economics, Washington, D. C.

LVW By correspondence on May 8, 1936.

II

**Table 30—Mississippi and Tennessee Shipments of Sweet Potatoes
To Chicago, Illinois**

L. C. L. price per bushel on the wholesale market.

Tenn. Nancy Halls 1934		Miss. Nancy Halls 1934		Tenn. Nancy Halls 1935		Miss. Nancy Halls 1935	
Jan. 2-	\$1.40-1.50	Jan.		Jan. 2-	\$1.00-1.10	January	
Jan. 8-	1.25-1.35			Jan. 8-	1.00-1.05		
Jan. 12-	1.25-1.25			Jan. 11-	1.00-1.00		
Jan. 19-	1.25-1.40			Jan. 16-	1.00-1.10		
Jan. 25-	1.35-1.40			Jan. 21-	1.00-1.10		
Jan. 31-	1.40-1.40			Jan. 24-	1.00-1.15		
Aug. 1-	1.25-1.35	Aug. 1-	\$1.85-1.90	Jan. 31-	1.00-1.10		
Aug. 2-	1.25-1.50	Aug. 3-	1.85-1.85	July 10-	.60-.65	Aug. 1-	\$1.15-1.25
Aug. 3-	1.25-1.40	Aug. 9-	2.00-2.00	July 17-	.40-.60	Aug. 2-	1.10-1.25
Aug. 6-	1.15-1.25	Aug. 14-	1.65-1.65	July 24-	.40-.60	Aug. 7-	1.10-1.15
Aug. 7-	1.25-1.25			July 31-	.40-.60	Aug. 9-	1.10-1.15
Aug. 8-	*2.00-2.00			Aug. 8-	1.10-1.15	Aug. 19-	1.15-1.15
Aug. 14-	*1.65-1.75			Aug. 15-	1.10-1.15	Aug. 20-	1.15-1.15
Aug. 20-	*1.50-1.60			Aug. 20-	1.15-1.15	Aug. 22-	1.20-1.25
Aug. 27-	*1.75-1.75			Aug. 23-	1.15-1.20	Aug. 23-	1.15-1.20
Aug. 31-	*1.40-1.50			Aug. 27-	1.10-1.15		
July 5-	2.00-2.00	July		Aug. 31-	.85-.95	July	
July 9-	1.75-2.00						
July 19-	1.75-1.85						
July 25-	1.50-1.65						
July 31-	1.50-1.75						

Tenn. Nancy Halls 1936		Miss. Nancy Halls 1936	
Jan. 2-	\$.90-.90	January	
Jan. 8-	.85-.90		
Jan. 10-	.85-.90		
Jan. 16-	.85-.85		
Jan. 27-	.85-.90		
Jan. 31-	.90-.90		

*New Stock

/Old Stock

Reference: Harold J. Clay, Associate Marketing Specialist

Fruit and Vegetable Division, U. S. Bureau of Agricultural Economics, Washington, D. C.

LVW By correspondence on May 8, 1936.

III

**Table 31—Prices Received by Mississippi Producers for Sweet Potatoes
15th of each Month, 8 years, 1928-1935**

	CENTS PER BUSHEL												Simple Average
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1928	90	90	100	100	110	110	100	140	130	115	95	100	107
1929	105	115	115	120	120	125	130	125	115	100	80		111
1930	85	95	100	100	105	105	105	125	135	110	85	90	103
1931	90	90	95	100	100	100	80	90	65	60	50	50	81
1932	50	55	55	55	55	55	55	60	55	45	34	33	51
1933	37	39	50	45	50	50	60	85	75	60	55	60	55
1934	65	70	75	80	80	85	85	90	80	75	60	60	75
1935	62	65	65	70	70	70	75	85	80	65	65	65	70
Simple Average	73	77	82	84	86	87	86	100	92	79	65	67	81.6
1936	65	70	70	70	75	75							
1937													

Reference: Crops and Markets, U. S. Bureau of Agricultural Economics, Washington, D. C.

4. Labor Requirements

I

Table 32—Labor Required for an Acre of Sweet Potatoes in South Georgia

MAN LABOR											
Operation	Total Hours	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.
Bed Seed.....	2.6		1.3	1.3							
Break	5.2	3.5	1.7								
Prepare, distribute fertilizer and transplant	35				10.5	14.	10.5				
Cultivate	10.1				1.7	3.4	3.4	1.7			
Hoe	10.9				1.8	3.6	3.7	1.8			
Harvest	42.9								14.3	14.3	14.3
Market	8.1									4.1	4.0
TOTAL.....	114.8	3.5	3.0	1.3	14.0	21.0	17.6	3.5	14.3	18.4	18.3
MULE LABOR											
Bed Seed.....	.5		0.2	0.3							
Break	10.5	7.0	3.5								
Prepare and transplant	10.8				3.5	4.7	3.6				
Cultivate	9.9				1.6	3.3	3.3	1.7			
Harvest	13.5								4.5	4.5	4.5
Market	10.7									5.4	5.3
TOTAL.....	56.9	7.0	3.7	0.3	5.1	8.0	6.9	1.7	4.5	9.9	9.8

These figures are based on studies made by the Georgia State College of Agriculture and the U. S. Department of Agriculture.

Reference: Georgia Extension Bulletin 273, table 8, page 31, "Systems of Farming for South Georgia," January 1923, Athens, Georgia.

II

Table 33—Sweet Potatoes—Man Labor and Horse Work by Operations—5 Farms—Jones County, Miss.—1928

MAN LABOR PER ACRE								
Farm Number	Acres Per Farm	Bed Seed	Prepare Land and Fertilizer	Transplant	Cultivate and Hoe	Harvest	Total	Yield Per Acre
10	.23	.....	17.4	78.3	8.7	82.6	187.0	283
2	.47	.....	4.3	6.4	8.5	27.7	46.9	53
12	.27	22.2	40.7	14.8	18.5	148.1	244.3	185
5	1.21	.....	29.7	6.6	19.0	44.6	99.9	85
4	.62	9.7	16.1	41.9	14.5	64.5	146.7	48
Wt. Av.	.56	4.3	22.5	21.1	15.3	59.3	122.5	97
HORSE LABOR PER ACRE								
10	.23	.....	34.8	.....	.....	121.7	156.5	283
2	.47	.....	4.3	.....	8.5	8.5	21.3	53
12	.27	.....	40.7	.....	18.5	37.0	96.2	185
5	1.21	.....	34.7	.....	14.9	29.7	79.3	85
4	.62	.....	16.1	.....	14.5	16.1	46.7	48
Wt. Av.	.56	.....	26.1	.....	12.9	31.4	70.4	97

Reference: Mississippi Agricultural Experiment Station Bulletin 269, table 14, page 13, June 1929, "Progress Report of Cost of Production Route in Jones County, Mississippi, 1928," State College, Miss.

III

Labor Required for Sweet Potatoes in Louisiana

In planting sweet potatoes there are really three operations—pulling the plants,

dropping in rows and setting out. There were not a sufficient number of estimates on pulling to give a reliable average.

Table 34—Dropping and Setting Sweet Potato Plants

	Width of Row	Number of Reports	Average Acreage Per Day	Acreage reported most frequently
Dropping (1 man)	3 ft.	20	1.30	1 (8 reports)
	3½ ft.	24	1.13	1 (12 reports)
Setting (1 man)	3 ft.	20	1.17	1 (8 reports)
	3½ ft.	24	1.04	1 (12 reports)

The various operations in cultivating sweet potatoes with crew duty at each, are shown in Table.

Table 35—Cultivating Sweet Potatoes

	Width of Row	Number of Reports	Average Acreage Per Day	Acreage reported most frequently
Barring off with turn plow (2 furrows, 1 man and 1 mule)	3 ft.	10	3.00	3 (10 reports)
	3½ ft.	12	3.16	3 (6 reports)
Cultivating (2 furrows, 1 man and 1 mule)	3 ft.	41	3.00	3 (11 reports)
	3½ ft.	21	3.14	3 (11 reports)
Hoeing (1 man)	3 ft.	16	.70	0.5 (7 reports)
	3½ ft.	15	.74	0.5 (7 reports)

Turning vines is an operation which is necessary when it is desired to cultivate the crop after the vines have reached considerable length. Otherwise, the plow would break and tear away many of them. No figures are presented for this operation, however, as the number reporting was not large enough to give a reliable average.

Some method of removing the vines is usually employed before plowing up sweet potatoes. They may be cut and raked off or they may be dragged off. Potatoes are generally plowed up with a middle buster. However, some growers still use the turning plow, going twice or four times to the row. There are so few who market potatoes in this area that no figures for this operation are given.

Table 36—Harvesting Sweet Potatoes

Operation	Width of Row	Number of Reports	Average Acreage Per Day	Acreage Reported Most Frequently
Cutting vines (1 man)	3 to 4 feet	14	0.93	1 (7 reports)
Dragging vines, turn plow (1 man and 1 mule)	3 to 4 feet	12	2.79	Scattering
Plowing up, middle buster (1 man and 2 mules)	3 feet	13	4.38	4 (5 reports)
	3½ feet	19	4.57	(4 (5 reports) (6 (6 reports))
Picking up (1 man) (average bushels per acre, 135)		53	.42	(0.33 (16 reports) 0.50 (12 reports))
Hauling to barn (Yield per A.)				
2 men and 2 mules 40-200 bu.		23	1.62	Scattering
3 men and 2 mules 40-210 bu.		13	1.87	Scattering

Labor Requirements of Sweet Potatoes

The sweet potato crop requires more labor than cotton. The number of operations is large, and some of them, such as breaking and bedding, may be done two,

three, or even four times before the plants are set out. This accounts for the large labor requirements for these operations. Planting, hoeing, and harvesting each requires a considerable amount of hand labor. The crop is usually hoed once.

Table 37—Labor Requirements per Acre on Sweet Potatoes, By Operations

Operation	Hours Per Acre		No. of Rpts.	Operation	Hours Per Acre		No. of Rpts.
	Man	Mule			Man	Mule	
Break	14.4	10.0	40	Cultivate (average 1-¾ times)	8.1	8.3	29
Bed	7.5	8.0	51	Cultivate middles	2.8	2.8	29
Rebed	6.0	6.5	14	Hoe	19.7	.....	51
Drag beds	2.5	1.2	38	Cut vines	12.4	.....	15
Center furrow	1.7	1.7	14	Drag vines	3.6	4.5	26
Fertilize	3.2	2.4	22	Plow up	4.7	6.9	53
Drop plants	9.2	.....	53	Pick up	26.4	.....	53
Set plants	10.4	.....	53	Haul	21.0	15.6	52
Bar off	3.2	3.2	25				

Reference: U. S. Department of Agriculture Bulletin 961, pages 20, 21 and 22, tables 32, 33, 34 and 35, August 1921, "Standards of Labor on the Hill Farms of Louisiana," Washington, D. C.

IV

Table 38—Average Man Labor and Mule Work Required for Sweet Potatoes in the Pee Dee Area of South Carolina

	April		May		June		July		October		Total
	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-30	
Man Labor	4.2		3.5	11.4	6.0	6.6	6.6	6.1	20.0	47.6	112.0
Mule Wk.	8.4		4.0	4.5	3.0	3.0	3.0	2.8	8.1	17.2	54.0

Reference: South Carolina Agricultural Experiment Station Bulletin 269, tables 11 and 12, "Pee Dee Farm Management Studies, 1925-1930," January 1931, Clemson College, South Carolina.

D. THE VALUE OF SWEET POTATOES AS FEED

Is it economical to grow sweet potatoes on your farm for fattening hogs? For feeding to other types of livestock?

How much corn can be saved by an acre of sweet potatoes? How much protein feed?

Is it more economical to feed sweet potatoes alone or with other feeds? What feeds can you more economically feed with sweet potatoes on your farm?

Use Form 2 for getting the economy of various sweet potato rations.

I

Sweet Potato Feeding Experiments With Hogs 1928-1932 at Louisiana State University, Baton Rouge, Louisiana

The purpose of this experiment was to determine the feeding value of:

1. Sweet potatoes fed in dry lot with and without tankage.
2. Sweet potatoes versus corn.

In November, 1927, the University had on hand about 2,000 bushels or more of Porto Rico sweet potatoes for hog feeding. Grade hogs previously fed on garbage from the University dining hall were used in this experiment to test the value of sweet potatoes for fattening hogs as compared to corn, and the value of a tankage and sweet potato ration compared to sweet potatoes alone. The hogs were fed in dry lot. The winter was relatively cold, and some of the potatoes were slightly frozen. Tankage was fed free choice.

Table 39—Value of Tankage With Sweet Potatoes Fed in Dry Lot At Baton Rouge, Louisiana

December 8, 1927, to January 19, 1928 (42 days) 10 hogs per lot.

Ration	Corn Tankage	Sweet Potatoes Tankage	Sweet Potatoes No Tankage
	Pounds	Pounds	Pounds
Average initial weight.....	104.3	104.3	104.3
Average final weight.....	168.5	142.7	115.5
Gain per pig.....	64.2	38.4	11.2
Average daily gains.....	1.53	.91	.27
Average daily ration:			
Corn.....	5.1		
Sweet Potatoes.....		15.3	15.6
Tankage.....	.88	1.58	
Feed per 100 pounds gain:			
Corn.....	5.96 Bu.		
Sweet potatoes.....		33.4 Bu.	117.05 Bu.
Tankage.....	57.9	173.2	
Mineral.....	1.09	2.34	3.56

The pigs on sweet potatoes alone were unthrifty, scoured considerably, and did not relish their potatoes as well as did those in Lot II receiving tankage. These hogs gained only a quarter of a pound per day (.27), and would have sold for less money per pound than at the beginning of the experiment.

Pigs on sweet potatoes and tankage gained more rapidly than on sweet potatoes alone, but not as rapidly as on corn and tankage. In this lot, there were less scouring than with potatoes alone. Pigs in this lot ate slightly more mineral matter than did those in the corn lot.

Sweet potatoes fed alone had a low feeding value compared to corn. One hundred pounds of sweet potatoes replaced only 5.7 pounds of corn and 1 pound of tankage (.99). One hundred pounds of tankage replaced 2414 pounds of sweet potatoes.

III

Sweet Potatoes Compared With Shelled Corn As A Fattening Feed For Swine at Experiment, Georgia

This feeding test was carried on for 70 days, from November 1, 1927, to January 19, 1928. Twenty-four head of well grown, thrifty, pure bred Poland-China pigs of similar blood lines were used. These pigs averaged about 230 days old at the start of this test. They were divided into two uniform and similar groups of 12 head each.

The first group was fed on sweet potatoes, digester tankage (60 per cent protein) and mineral mixture, self-fed free choice.

The second group was similarly fed on shelled corn, digester tankage, and mineral mixture. The mineral mixture was composed of 75 pounds powdered wood charcoal, six pounds common salt, six pounds marble dust three pounds flowers of sulphur, six pounds Glauber's salts, three pounds raw stock phosphate, and one pound powdered copperas. Animals were weighed on three consecutive days at the start and close of the test and at 14-day intervals throughout.

The shelled corn, digester tankage, and mineral mixture were fed by means of a self-feeder so as to be available at all times. The sweet potatoes were fed in a box-like frame on a concrete feeding floor so as to be available to the pigs whenever desired and so as to prevent them from being rooted out and wasted. This test was made under dry-lot conditions. The potatoes were of Porto Rico variety, raised locally and were generally of good, sound quality but contained many off-grade size and shape for market requirements. Toward the close of the test there was some rot among the potatoes, but practically all rotted roots were culled out before being fed. The shelled corn was a white prolific type, raised locally, and of the Whatley variety.

Form 2—A Suggestive Method of Determining, for A Given Farm, the Relative Value of Various Feeds or Combinations of Feeds for Fattening Hogs

[illegible]

*Use estimated yield per acre on this farm to determine number of acres required. Where two crops are grown together, as corn and soybeans, care should be taken that acreage is not figured for each.

**Table 40—Sweet Potatoes Compared With Shelled Corn As A Fattening Feed
For Swine At Experiment, Georgia**

	Lot I Sweet Potatoes (Pounds)	Lot II Shelled Corn (Pounds)
Average initial weight of pigs.....	96.9	98.5
Average final weight of pigs.....	145.6	207.1
Average daily gain per animal.....	0.70	1.55
Average total gain (per animal).....	48.7	108.6
Average daily feed consumption per pig:		
Sweet potatoes	14.82	.....
Shelled corn .....	.....	6.27
Digester tankage	0.80	0.59
Mineral mixture	0.0292	0.0095
Feed consumed per 100 pounds gain:		
Sweet potatoes.....	42.5 Bu.	.....
Shelled corn .....	.....	7.22 Bu.
Digester tankage	115.0	38.8
Mineral mixture	4.19	0.61

The greatest gains were made when the pigs consumed the largest amounts of the potatoes. They appeared to be fairly palatable to the pigs at all times but their bulky nature seemed to prevent the pigs from consuming them in sufficient amounts to produce really satisfactory gains. It was quite noticeable that the pigs fed sweet potatoes soon became paunchy, with distended middles. Perhaps the capacity of the animals for food was increased as the stomachs became distended and it may be that this explains why better gains were made after the fourth week than before.

Reference: Georgia Agricultural Experiment Station Bulletin 181, pages 5, 6, and 7, table 1, April 1934, "Sweet Potatoes as a Feed for Swine," Experiment, Georgia.

IV

Sweet Potatoes Alone and With Tankage as Hog Feed at Louisiana State University, Baton Rouge,, Louisiana

In 1928, four acres of Porto Rico sweet potatoes were planted for hog feeding and divided into two lots of two acres each. The yields were estimated at 194 bushels per acre or 21728 pounds of potatoes for each lot.

Twenty feeder pigs of fair quality averaging 103.1 pounds were bought on the New Orleans market, and divided into two equal lots. Lot I received tankage, and Lot II no tankage. Finding that this number of hogs was not enough to clean all the potatoes, 20 more feeder pigs weighing 83.8 pounds each were bought on January 7, and divided equally between the two lots. These pigs were of a little better grade than those in the first lot, but a little small to use potatoes to best advantage.

Tankage used was a good grade of 60% digester tankage donated by Swift and Company, Chicago, and was fed to Lot I in a self-feeder.

Fifteen hogs sent to the New Orleans market sold for 9½ cents per pound, the top market price, equal to 8 cents per pound at feed lot weights.

For convenience, the results have been averaged in Table 41 on the basis of twenty hogs per lot for 35 days, instead of 49 days and 21 days, respectively, for the two groups.

Table 41—Period of Test, 10 Hogs, December 12, 1928—January 30, 1929; and 10 Hogs, January 7, 1929—January 30, 1929; (Average 35 days)

Ration	Lot I	Lot II
	Sweet Potatoes in field Tankage	Sweet Potatoes in field No Tankage
Number of hogs.....	20	20
Average initial weight.....	93.5	93.5
Average final weight.....	144.5	123.9
Average gain.....	51.0	30.45
Average daily gain.....	1.46	.87
Feed per head		
Sweet potatoes, estimated.....	20.72 Bu.	20.72 Bu.
Tankage.....	16.25	
Average daily feed:		
Sweet Potatoes, estimated.....	31.04 Lbs.	31.04 Lbs.
Tankage.....	.46	
Feed per 100 pounds gain:		
Sweet potatoes.....	42.6 Bu.	71.3 Bu.
Tankage.....	31.9	

!Note: It is probable that the yields of sweet potatoes were either over-estimated or there was considerable waste of potatoes from rotting in the field. In other experiments, pigs of that size have not eaten such large amounts of potatoes. The value per acre would not be changed by lowering the estimates of daily consumption but the feeding value per bushel would be greater.

The hogs in the lot receiving tankage had a smoother finish and were less paunchy. Hogs on sweet potatoes alone scoured more, and would have required several weeks of corn feeding to finish for market. They were valued locally at 1 cent per pound less than those receiving tankage.

Reference: Louisiana Experiment Station Bulletin 236, pages 22 and 23, table 8, March 1933, "Hogging Off Corn and Sweet Potatoes," Baton Rouge, Louisiana.

V

The Value of Sweet Potatoes When Grazed By Fattening Swine at Experiment, Georgia, 1932

The grazing test was made on two areas of adjacent land of one acre each. The soil was practically identical in both areas in type and fertility. One of the areas was planted in corn of Whatley's Prolific variety (white) and the other was planted in sweet potatoes of the Porto Rico variety. Rows in both areas were three and one-half feet apart and all operations in planting and cultivation were carried on so as to fairly represent common practices with the two crops. The unusually dry weather which prevailed during a part of the growing season resulted in the yields being cut heavily, especially for the corn. The yield of corn was estimated at about 10 bushels and the yield of potatoes at about 75 bushels. It will be seen from these estimates that the yield of corn was unusually low while the potato yield, although low, was not cut nearly as much by the dry weather as was the corn.

On September 21, 1932, 20 head of uniform, thrifty, pure bred Poland-China pigs, averaging about 103 pounds each, were divided into comparable groups and placed in the two one-acre fields of corn and of potatoes, 10 head in each field. These pigs were allowed access in each field to self-feeders containing digester tankage (60 per cent protein) and mineral mixture, free choice. The mineral mixture was composed of equal parts by weight of marble dust (calcium carbonate), steamed bone meal, hardwood ashes, and salt. All animals were weighed on three successive days for averages when placed on grazing and when taken off. They were weighed also at regular 14 day intervals during the test. Fresh water was available at all times to all animals. The pigs in the potato field were hand-fed shelled white corn at the rate of about two pounds per head daily throughout the test. This was done in troughs so as to prevent waste.

On September 29 it was seen that the corn grazing had been practically exhausted in the second lot and it was necessary to allow these pigs two pounds of shelled corn from that time until their regular two weeks weighing time. They were then weighed out of the test. Because of the fact that the pigs in the potato lot were making slow headway in consuming their potatoes it was decided to put the 10 pigs from the completed corn grazing in the potato field so as to make 20 head on potato grazing. These 20 pigs grazed together until October 18 when final weighings were made. The summary of results is found in Table 42.

Table 42—The Value of Sweet Potatoes When Grazed by Fattening Swine
TEN PIGS PER LOT

	Lot I	Lot II
	Sweet Potato Grazing (Pounds)	Corn Grazing (Pounds)
Total gain for lot.....	474.7	65.2
Average daily gain.....	1.13	0.47
Estimated yield per acre.....	75 Bu.	10 Bu.
Average extra feed consumed daily:		
Shelled corn	1.95	0.79
Digester tankage	0.44	0.16
Mineral mixture	0.0119	0.0357
Extra feed consumed per 100 pounds gain:		
Shelled corn	3.08 Bu.	3.01 Bu.
Digester tankage	39.0	33.7
Mineral mixture	1.05	7.67

The pigs grazed on the sweet potatoes developed the typical paunchy and watery abdomens as noted in the preceding reports of potato feeding tests. However this was not so marked in the dry-lot feeding experiments.

It will be noted that the mineral mixture consumption was heavier in the corn lot than in the potato lot. This is contrary to the results secured previously in the dry-lot feeding tests. Perhaps this is explained by the fact that the pigs necessarily consumed more earth and minerals in rooting up potatoes and had less need for the prepared mineral mixture than did the corn pigs. Also the consumption of tankage was much higher in the potato lot; the mineral content of tankage is very high and would take the place of the mineral mixture to some extent.

The Second Experiment On the Value of Sweet Potatoes When Grazed By Fattening Swine at Experiment, Georgia, in 1933

This test was a repetition, in its main features, of the work done in 1932. This was made the following year on the identical two one-acre areas, but the corn was planted on the land that had been in potatoes and vice versa. The same planting and cultural methods were used. The season was much more favorable, and fair yields were made on both areas. The yields were estimated at about 30 bushels of corn and 90 bushels of sweet potatoes.

The feeding methods were similar to those employed in the other Experiment and the experimental procedure followed the same general plan. Eighteen pigs averaging about 140 pounds were divided into two uniform groups of nine each for the two fields. All pigs used were pure-bred Poland-Chinas with the exception of two head of O. I. C. pigs in the corn lot and three O. I. C. pigs in the potato lot. The pigs were started on grazing October 12, 1933.

The corn grazing was exhausted after 30 days and the pigs in this lot were then weighed out of the test. The sweet potato grazing lasted for 42 days, at which time that lot was weighed out the test.

**Table 43—The Second Experiment On The Value of Sweet Potatoes
When Grazed By Fattening Swine**
NINE PIGS PER LOT

	Lot I Sweet Potato Grazing (pounds)	Lot II Corn Grazing (pounds)
Average initial weight.....	140.9	139.6
Average final weight.....	213.5	180.7
Average gain	72.6	41.1
Total gain	653	370
Average daily gain.....	1.73	1.37
Estimated yield per acre.....	90 Bu.	30 Bu.
Average extra feed consumed daily:		
Shelled corn	1.95	.....
Digester tannage	0.99	0.66
Mineral mixture	0.0529	0.0630
Extra feed consumed per 100 pounds gain:		
Shelled corn	2.03 Bu.	.....
Digester tannage	57.9	48.1
Mineral mixture	3.09	4.59

Reference: Georgia Agricultural Experiment Station Bulletin 181, pages 11, 12, 13 and 14, tables 4 and 5, April 1934, "Sweet Potatoes As A Feed For Swine," Experiment, Georgia.

VI

Hogs grazing on sweet potatoes ate the vines as well as the potatoes. Samples of the vines were taken for analysis in 1920 and 1921. The results of these analyses are given on the dry basis. The samples were taken from the end of the vines back three feet and divided into three parts; the first foot is the extreme tip of the vine, the second comes next, and the third foot is nearest the hill.

Table 44—Analysis of Sweet Potato Vines

Sample	Crude Protein %	Fat %	Carbo- hydrates %	Crude Fiber %	Water %	Ash %
First foot from tip.....	14.84	3.07	50.60	14.97	5.37	11.12
Second foot	13.25	3.32	49.60	17.08	4.86	11.87
Third foot	10.72	3.42	48.85	18.30	5.15	13.37

The green vines contained about 85% of water. The crude protein and the carbohydrates decrease as the distance from the tip of the vine is increased, while the fat, the crude fiber and the ash increase.

Reference: Louisiana Agricultural Experiment Station Bulletin 187, page 19, table 14, February 1923, "Hogging Down Crops," Baton Rouge, Louisiana.

VIII

The Value of Sweet Potatoes As A Feed For Hogs At Baton Rouge, La.

This experiment was conducted with pigs produced on the Louisiana State University hog farm. Most of them were late spring pigs. They had previously been on soybeans in the field with some corn and a protein supplement. A few had been on a field of corn and soybeans. The lots were divided as follows:

Lot I. Corn, with protein supplement, in dry lot—(check)

Lot II. Corn, sweet potatoes, with protein supplement, in dry lot.

Lot III. Sweet potatoes in field (1.29 acres) (White variety of Porto Ricos), with protein supplement.

Lot IV. Sweet potatoes in field (yellow Porto Ricos—1.03 acres) with protein supplement.

The protein supplement used was of equal parts shrimp bran and cottonseed meal fed together in self-feeders. A simple mineral mixture of bone meal, ground oystershell and salt (40-40-20, was available also.

In this test, the potato vines were green during the entire test, and furnished some feed for the two lots in the field. Lot II on sweet potatoes and corn, fed in

dry lot were given as many potatoes as they would clean up, with a limited amount of ear corn.

**Table 45—Feeding Period—Lots I, II, III, October 28-December 1,
Lot IV, November 3-December 4, 1931**

	Lot I	Lot II	Lot I	Lot II
	Corn Supplement	Sweet potatoes Corn Supplement	Sweet Potatoes (White) Supplement	Sweet Potatoes (Porto Rico Yams)
Number of hogs.....	8	8	16	13
Days on test.....	34	34	34	31
Acres potatoes.....			1.29	1.03
Average initial weight....	153	156	154	156
Average final weight....	218	224	209	206
Average total gain.....	65	68	55	50
Average daily gain.....	1.9	2.0	1.61	1.62
Average daily feed: (lbs.)				
Corn (shelled basis 14% moisture).....	6.6	2.1		
Sweet Potatoes.....		13.4	25.1*	28.5*
Shrimp bran.....	.33	.52	.61	.62
Cottonseed meal.....	.33	.52	.61	.62
Feed per 100 lbs. gain				
Corn (shelled) (Bu.).....	6.18 Bu.	1.86 Bu.		
Sweet potatoes (Bu.).....		13.4	31.14*	35.24*
Shrimp bran (Lbs.).....	17.4	32.7	38.1	38.6
Cottonseed meal (Lbs.).....	17.4	32.7	38.1	38.6

*Estimated

One acre of sweet potatoes (188 bushels) hogged down produced 632 pounds pork, or about the same amount as would be produced from 40 bushels of corn; after allowing for differences in protein supplements eaten.

A white variety of sweet potatoes contained a higher percentage of starch and less sucrose than the yellow Porto Rico yams, seemed to cause less scouring and apparently put on gains for 11.8% less potatoes per 100 pounds gain.

Partial Analysis of Potatoes Fed	White Variety	Yellow Porto Rico
Starch.....	28.85	19.98
Sucrose (sugar).....	2.41	3.69
Invert sugar.....	.96	.66
Water.....	67.30	68.60

Reference: Louisiana Agricultural Experiment Station Bulletin 236, pages 24, 25, and 26, table 10, March 1933, "Hogging Off Corn and Sweet Potatoes," Baton Rouge, Louisiana.

VIII

Sweet Potato Feeding Experiment With Hogs in Field and Dry Lot—1932 at Louisiana State University, Baton Rouge, Louisiana

Objects of the experiment:

1. To retest the value of sweet potatoes fed in dry lot with a protein supplement only.
2. To retest the value of adding corn to sweet potato rations.
3. To compare white and yellow sweet potatoes in dry lot tests, combined with corn and protein supplements.
4. To determine the value of hogging off corn and soybeans with sweet potatoes in the same field.

Probably no one is going to harvest potatoes for hogs and feed them in a dry lot where it is practicable to hog them off in the field. Many of the potatoes fed however are culls and these are usually fed under practically dry lot conditions. The main purpose of a dry lot test is to get accurate records of the sweet potatoes eaten.

The hogs used were principally purebred barrows and sows owned by the University with twelve high grade hogs purchased to fill the lots. These hogs had been on full feed previous to the experiment, which is probably one reason why

smaller gains were made on potatoes in 1932 as compared to 1931 (Table 45).

The two lots fed in the field had approximately .6 of an acre of sweet potatoes each. Three rows in each field were harvested and weighed to determine the yield. Lot 5 had one-half acre of corn and soybeans in addition. Representative rows of corn were gathered and samples shelled to determine the yield of corn. Sections of rows of soybeans were gathered and thrashed out to estimate the amount of soybeans. No leaves were on the soybeans at the beginning of the test. There were more beans than the hogs could clean up. The corn in Lot 5 was finished in 16 days and some corn was hand-fed the last 11 days.

There were two heavy rains during the experiment, and some parts of the field that lay rather low were packed down considerably by the hogs. Toward the end of the experiment, most of the rows were opened up with the plow as the hogs did not appear to be getting all the potatoes.

Table 46—Sweet Potato Feeding Experiment 1932—Days of Test October 6 to November 2, 1932 (27 days)

	Lot I	Lot II	Lot III	Lot IV	Lot V	Lot VI
Number of pigs	8 Dry Lot	8 Dry Lot	8 Dry Lot	8 Dry Lot	10 In Field	10 In Field
Ration	Ear Corn Supplement	Ear Corn White S. Potatoes Supplement	Ear Corn P. Rico Swt. Pot. Supplement	Porto Rico S. Potatoes Supplement	Ear Corn* White S. Potatoes Supplement Soybeans	Ear Corn† White S. Potatoes Supplement
Av. initial weight (lbs.)	149.0	148.4	148.2	148.0	148.0	147.65
Av. final weight (lbs.)	193.5	188.2	189.5	179.8	191.1	185.5
Av. gain (lbs.)	44.5	39.8	41.3	31.8	43.1	37.85
Average daily gain (lbs.)	1.65	1.47	1.53	1.18	1.59	1.40§
Av. daily feed:						
Corn (shelled) basis 14% moisture	6.39	2.85	2.85	.....	2.23	2.16
Sweet potatoes	.....	11.94	11.94	23.3	11.6	14.81
Supplement — see below	.86	1.10	1.10	1.94	1.08	1.10
Soybeans	.....	.....	.....	.....	.64§	.....
Feed per 100 pounds gain:						
Corn (shelled) basis (bu.)	6.9	3.4	3.3	.....	2.5	2.7
Sweet potatoes (bu.)	.....	16.3	15.6	39.4	14.5	21
Shrimp meal (lbs.)	26.1	37.8	36.2	82.5	33.8	39.6
Cottonseed meal (lbs.)	15.7	22.7	21.8	49.5	20.3	23.7
Alfalfa-ground hay (lbs.)	10.4	15.1	14.5	33.0	13.5	15.8
Soybeans—estimated (lbs.)	.....	.....	.....	.....	40.0	.....

*Ear corn hogged off 16 days, hand fed 11 days.

§Soybeans estimated.

†Ear corn hand fed.

Comparing Lot 3 (corn and potatoes) and Lot 4 (potatoes only), it evidently paid to add corn to a ration of sweet potatoes and protein supplement. Each 100 pounds corn replaced 844 pounds potatoes and 49.7 pounds protein supplement.

Comparing 1 (corn alone) and 4 (potatoes alone), 100 pounds of corn would be equal to 510 pounds of potatoes and 29.1 pounds protein supplement. Taking into account the result given above corn was more valuable when added to a potato ration than when fed as the only fattening feed.

Comparing Lot 1 (corn alone) and 3 (corn and potatoes), 100 pounds of corn replaced 389 pounds sweet potatoes and 10 pounds protein supplement, or 100 pounds concentrates replaced 433.5 pounds sweet potatoes. This is the best showing made by potatoes and shows that potatoes made best gains when fed with a concentrate like corn as well as with a protein supplement.

Reference: Louisiana Agricultural Experiment Station Bulletin No. 236, pages 26, 27 and 28, table 11, March 1933. "Hogging Off Corn and Sweet Potatoes," Baton Rouge, Louisiana.

IX

Comparing Shelled Corn With Sweet Potatoes and Corn For Fattening Pigs

This feeding test was a part of soft pork studies (See Section XII of this division) and was carried on for a 70-day period, March 5 to May 14, 1930. The pigs were divided into two uniform and comparable groups of nine head each. The animals used in this test were of Duroc-Jersey and of mixed Duroc-Jersey and Poland-China breeding, fairly uniform in type. All had been immunized against hog cholera and were thrifty and well developed. The average initial weights at the start of the test were between 125 and 130 pounds. Weighings were made at regular 14-day intervals with triple weighings at one-day intervals for the start and close of the experiment.

Table 47—Comparing Shelled Corn With Sweet Potatoes and Corn For Fattening Pigs

	Lot I Sweet Potatoes With Corn (Lbs.)	Lot II Shelled Corn (No Potatoes) (Lbs.)
Average initial weight of pigs.....	126.6	129.1
Average final weight of pigs.....	220.2	251.0
Average gain per animal.....	93.6	121.9
Average daily gain per animal.....	1.34	1.74
Average daily feed consumption per pig:		
Sweet potatoes	11.13	.....
Shelled corn	2.33	7.15
Supplement mixture	1.40	1.03
Feed consumed per 100 pounds gain:		
Sweet potatoes	16.6 Bu.	.....
Shelled corn	3.10 Bu.	7.33 Bu.
Supplement mixture	104.5	59.4

Both lots of pigs were fed under dry-lot conditions on concrete feeding floors. Those in the first lot received sweet potatoes and a protein-mineral supplemental mixture, free choice and self-fed, with shelled corn hand-fed once daily to the lot at the rate of two and one-third pounds per head. Those in the second lot received shelled corn and the same protein-mineral supplemental mixture, free choice self-fed. Fresh water was available at all times. The protein-mineral supplement for both lots and the shelled corn for the second lot were fed in self-feeders of standard type. The sweet potatoes were fed in low frames on a concrete floor and were put in fresh at least once daily or oftener, when necessary, so as to be available at all times. The shelled corn for the first lot was hand-fed late in the afternoon each day. This time for feeding was chosen so as to encourage them to eat as many sweet potatoes as possible during the early part of the day when their appetites were keenest. Observations indicate that when corn is fed too early in the day the pigs do not consume as many sweet potatoes as when it is fed late.

The sweet potatoes used in this test were locally grown and of the Porto Rico variety. They were sound but of lower grade than average, with many of poor shape and unmarketable size. The shelled corn used was of the Whatley's Prolific variety (white) and raised locally. The protein-mineral supplemental mixture contained 60 parts by weight of cottonseed meal (42 per cent protein), fifteen parts fish meal (55 per cent protein), seven and one-half parts digester tankage (60 per cent protein), seven and one-half parts dried buttermilk, seven and one-half parts alfalfa leaf meal, one part common salt, one-part marble dust (calcium carbonate), and one part cod liver oil.

The consumption of sweet potatoes was good and not much lower than in previous experiments when the potatoes were fed without corn. The sweet potatoes caused the same paunchiness of form noted in the previous experiments. This paunchiness of abdomen produces a wasty carcass and is discriminated against in price by the butchers and packers. A study of the results make it seem probable

that better and more economical results would have been obtained by feeding a large amount of shelled corn with the potatoes. It appears that it would be most economical and best to feed approximately half of a "full ration" of shelled corn and allow sweet potatoes to compose the remainder of the ration when a protein supplement is allowed.

Reference: Georgia Agricultural Experiment Station Bulletin 181, pages 9, 10, and 11, table 3, April 1934, "Sweet Potatoes as a Feed For Swine," Experiment, Georgia.

X

Kidder and Dalrymple⁴ in 1919-22 conducted experiments in hogging off corn and soybeans, corn and cowpeas, corn, soybeans, and sweet potatoes alone. As the different crops were hogged off in rotation, it is not possible to make very definite comparisons, and there was considerable variation in results.

The following table shows the gains per acre.

Table 48—Hogging Down Crops—1919-1922, Louisiana Experiment Station, Baton Rouge, Louisiana

No. of Tests	Crop Hogged Off	Gains Per Day	Pork Per Acre	Yield in Bushels Per Acre		Feed per 100 Lbs. Gain Estimated	
		Lbs.	Lbs.			Lbs.	
4	Corn, cowpeas†.....	.98	272.6	Corn	27	554.7	Corn
				Cowpeas	1	39.	Cowpeas
2	Corn, Soybeans	1.01	255.3	Corn	12.4	315.6	Corn
				Soybeans	4.4	99.6	Soybeans
2	Corn	1.71	289.1	Corn	15.4	192.8	Corn
	Soybeans			Soybeans	2.0	20.4	Soybeans
	Sweet Potatoes			Swt. Potatoes	97.5	377.9	Swt. Pot.
3	Soybeans and			Soybeans	10.7	14.4	Corn*
	Sweet Potatoes	1.42	288.0	Swt. Potatoes	102.	97.	Beans
						870.	Lbs. Pot.
1	Sweet Potatoes/	102	212.5	Swt. Potatoes	75	45.2	Shrimpmeal
						1976	Potatoes

*Ate 19 pounds corn per hog in addition in 1919.

†Cowpeas were mostly forage.

§Soybeans and corn planted separately, but hogged off together.

/Ate 7.4 pounds shrimp bran in addition per hog.

4 Kidder, A. F. and Dalrymple, W. H., "Hogging Down Crops. Costs of Producing Crops and Pork," Louisiana Experiment Station, Bulletin 187, 1923.

It might seem that corn and cowpeas, and corn and soybeans were most economical but these were hogged-off by smaller and younger pigs weighing 80 to 90 pounds, and such pigs will always make smaller but more economical gains than larger hogs. The test on sweet potatoes was for one year only and was not representative. The yield was only 75 bushels per acre whereas 120 to 180 or more bushels should be obtained. The total gains on the soybean-sweet potato group was increased by feeding 670 pounds of corn in addition the first year. (1919)

Reference: Louisiana Experiment Station Bulletin No 236, pages 17 and 18, table 5, March 1933, "Hogging Off Corn and Sweet Potatoes," Baton Rouge, Louisiana.

XI

Tankage Compared to Soybeans As A Supplement To Sweet Potatoes For Fattening Hogs

One question of particular interest to the hog raiser at this time is whether purchased protein supplements can be replaced with home grown proteins. A crop of soybeans supplied an abundance of protein and where this crop is grown adjoining a sweet potato field, the soybeans can be used to advantage in supplying a part of the protein required to balance the sweet potatoes. It is certain that a small

amount of animal protein will be profitable, in addition to soybeans.

In 1929, two groups of 10 hogs each were finished on sweet potatoes. Each lot had 1½ acres of sweet potatoes (Porto Rico yams), Lot I had tankage as a protein supplement and Lot II in addition to potatoes had 1.1 acres of Biloxi soybeans, estimated to yield 16 bushels of beans per acre. This was probably an over-estimate or else there was considerable waste of soybeans later.

Table 49—Tankage Compared To Soybeans As Supplements To Sweet Potatoes Hogged Off in The Field

Period of Test—October 8, 1929 to December 3, 1929—56 days

Ration	Lot I	Lot II
	Sweet Potatoes in Field Tankage	Sweet Potatoes in Field Soybeans
Number of hogs.....	10	10
Average initial weight (lbs.).....	117.9	117.5
Average final weight (lbs.).....	174.9	160.8
Average gains (lbs.).....	56.8	43.3
Average daily gain (lbs.).....	1.01	.77
Total Feed:		
Sweet Potatoes (bu.).....	177.7	152.9
Tankage (lbs.).....	428.0	
Soybeans (bu.).....		18.4
Average daily feed:		
Sweet potatoes (lbs.).....	15.86	13.65
Tankage (lbs.).....	.764	
Soybeans (lbs.).....		1.97*
Feed per 100 pounds gain:		
Sweet potatoes (bu.).....	31.3	35.3
Tankage (lbs.).....	75.35	
Soybeans (bu.).....		4.2*

*Possibly an over-estimate.

The hogs on sweet potatoes with tankage made one-third greater gains, appeared to relish the potatoes better, and had a smoother finish.

The field hogged off with tankage made 454 pounds pork per acre. The field hogged off with soybeans produced 346.4 pounds pork per acre, if the soybean field is not included, or 184.2 pounds per acre if the soybean field is included.

Reference: Louisiana Agricultural Experiment Station Bulletin 236, pages 23 and 24, Table 9, March 1933, "Hogging Off Corn and Sweet Potatoes," Baton Rouge, Louisiana.

XII

Soft Pork Studies With Sweet Potatoes

(Refer to Table 40 (as Experiment 1) and Table 48 (as Experiment 3)

Observations have been made on the effect of sweet potatoes on the hardness of the fat produced by swine. The pigs used in Experiment I had been fed on peanuts for eight weeks before being divided into two groups which were fed on sweet potatoes and on corn as already described. Check animals, killed at the close of the peanut feeding period, showed soft and oily fat; leaf fat samples from them gave an average refractive index of 1.4628, while back fat samples gave an average refractive index of 1.4639. After the 70 days of feeding on sweet potatoes and on corn, most of the pigs showed firm fat such as is desired by the markets. The potato-fed pigs showed an average refractive index of 1.4585 for leaf fat samples and 1.4598 for back fat samples; the corn-fed pigs showed 1.4591 for leaf fat and 1.4600 for back fat. The carcasses gave an average grading of "medium hard" for the potato-fed pigs and "medium soft" for the corn-fed pigs. The gradings were as follows:

Classification	Potato	Hardened	Corn	Hardened
Hard	6		0	
Medium hard.....	2		5	
Medium soft	3		5	
Soft	1		2	

These data show that sweet potatoes are distinctly more efficient in overcoming softness in pork than is corn. When we consider that the corn-fed pigs had made 2.34 times as much gain on hardening feed as on softening feed while the potato-fed pigs had made only 1.06 times as much gain on hardening feed as on softening feed the difference becomes even greater in favor of sweet potatoes as a hardening feed. Figured by the number of points the leaf fat refractive indexes were lowered, the sweet potatoes had 2.57 times as much hardening effect per unit of gain produced from them as did the corn.

In Experiment 3 the pigs had been fed similarly on peanuts for eight weeks before being placed on the sweet potato and corn rations described. This peanut feeding produces a typical soft and oily carcass. After the 70 days on hardening feeds the pigs were slaughtered. The fat samples gave average refractive indexes of 1.4579 for those that had been fed on sweet potatoes and 1.4591 for those that had been fed on corn. This shows that the potatoes had greater hardening effect than did the corn. All carcasses in both lots were graded as "satisfactorily hard" by packing house graders according to commercial standards.

Reference: Georgia Agricultural Experiment Station Bulletin 181, pages 17 and 18, table 7, April 1934, "Sweet Potatoes As A Feed For Swine," Experiment, Georgia.

XIII

Feeding Sweet Potatoes to Workstock at Gainesville, Florida, 1908

The station had at its disposal 8 head of horses and mules. These were divided into 2 lots; one animal in each team in lot 1 and the other in Lot 2.

The animals were watered after feeding in the morning and before feeding at night.

The hay used in this experiment was what would be called A-1 beggarweed. The hay was run through the shredder to facilitate weighing. The roots were run through a cutting box or cut by hand before feeding.

The rations were weighed up each day. The refuse was weighed back each day and the animal was charged with just what it ate.

The animals were weighed 3 times the first week and the average taken as the initial weight. They were weighed once each week, thereafter until the last week when they were weighed 3 times again and the average taken as the final weight. Weighing was done before watering in the morning.

The following is a description of the animals used:

Team No. 1, Charley and George, were of medium weight draft horses about 9 years old, used for plowing and hauling throughout the greater part of the experiment.

Team No. 2, Peter and Kit, was of medium weight, mules, about 8 years old used for plowing and hauling.

Team No. 4, Logan and Joe, was rather light, mules about 5 years old, used for plowing and hauling.

Team No. 4, Maud and Fanny was rather light, mules about 6 years old, did no regular work, but since each did the same amount the rations are comparative.

The rations were made up after a 2-weeks preliminary period in which the

capacity of the animal was determined. All animals were in good condition at the beginning of this experiment.

Table 50—Sweet Potatoes As Feed For Work Stock in Florida, 1908

Animals Name	First Period 42 Days						Second Period 42 Days					
	Initial Weight	Gain or Loss (-)	Corn* Lbs.	Hay Lbs.	S. P. Lbs.	Corn Saved Lbs.	Initial Weight	Gain or Loss (-)	Corn* Lbs.	Hay Lbs.	S. P. Lbs.	Corn Saved Lbs.
Charley	1193	69	294	590	630	210	1240	-54	504	686	0	
George	1096	8	504	479	0		1114	-14	294	563	630	210
Peter	1071	31	252	443	630	138	1098	-30	504	435	0	
Kit	932	32	390	299	0		966	-26	192	273	503	312
Logan	921	37	210	342	606	202	938	-10	420	447	0	
Joe	145	43	412	474	0		974	-10	210	456	630	246
Maud	996	32	147	559	504	147	1016	20	294	726	0	
Fanny	911	45	294	517	0		960	0	147	531	504	147

*No statement in Bulletin 72 as to whether corn was shelled or in ear.

Animals mated in order named. Calculate value by using local prices.

Reference: Florida Agricultural Bulletin 72, 'Feeding, Home Grown Feeds to Farm Animals,' 1908, Gainesville, Florida.

XIV

Utilization Of Cull And Surplus Sweet Potatoes

A large portion of field-run sweet potatoes (the second largest vegetable crop in the United States) grown for market is graded out as culls (oversized and undersized) and is largely wasted. In 1931 the proportion of culls was reported to have reached 50 per cent in some localities. Present methods of utilizing culls are inadequate.

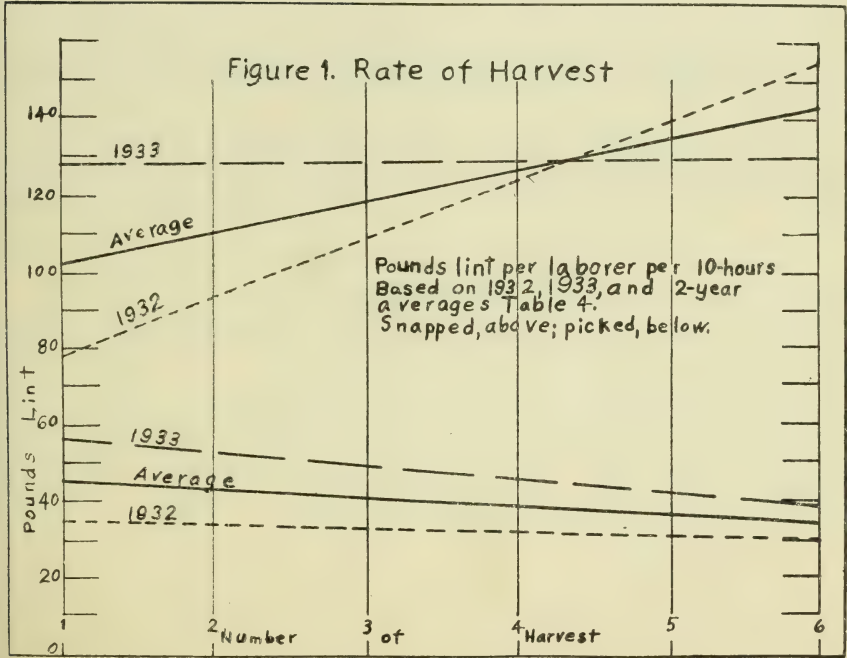
The method recently devised by the bureau for producing white starch of high quality from sweet potatoes has been improved, with the result that the yield has been increased, the process simplified, and the quality of starch has been rendered uniformly excellent. Possible uses for this starch are being investigated. In 1929 over 28,000,000 pounds of white potato starch was imported into the United States in spite of a duty of one and one fourth cents per pound (subsequently increased to two and one half cents). Imported white potato starch, because of its superiority in quality, has been selling at about one-half cent per pound above the domestic product.

All but a small proportion of the imported potato starch is used in the textile industry. It is believed that sweet potato starch of a quality satisfactory for this purpose can be produced at a satisfactory price. Some properties of pastes prepared from sweet potato starch, such as viscosity and penetrating power in cotton yarns, have been investigated, and the results indicate that this starch is suitable for sizing for cotton textiles. Some properties of sweet potato starch have been studied with an eye to other possible uses, and an investigation on modified starches and dextrins prepared from sweet potato starch has been started. The purpose of these investigations is to reveal uses that should absorb practically the entire output of culls. It is estimated, on the basis of carload shipments of marketable sweet potatoes, that if all sweet potato culls could be sold at a price equal to that which they would bring for use in starch production, the return to growers would be increased by some \$3,000,000 a year.

Reference: Annual Report of Department of Agriculture, page 7, "Report of the Chief of The Bureau Of Chemistry and Soils," August 31, 1932, Washington, D. C.

Effects of Delayed Harvesting by Picking and Snapping on Six Varieties of Cotton

BY
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SUMMARY

It was possible early in the season to obtain lint cotton by snapping 2.11 times as fast as by picking. This ratio increased to 3.91 by the last harvest.

The rate at which varieties could be snapped varied twenty-four percent. The rate at which they could be picked varied thirty-eight percent. The larger boll types could be harvested most rapidly by either method.

The amount of cotton to the acre did not seem to affect the efficiency of the workers except where the yield was very light.

Price premiums decreased on the picked cotton as damage, due to delayed harvesting and rain, increased.

Discounts for snapped cotton were usually greatest late in the season but varied widely.

Prices for snapped and picked cotton of the same variety harvested on the same date differed as little as forty points at times and over 140 points at other times.

The increased yield of snapped cotton over picked, due to the inclusion of plant parts, decreased, materially, the price differential as indicated by value per acre, but probably would not do so if snapping should become a general practice.

Delayed harvesting affected the seed chiefly by increasing the free fatty acid content of the oil and by decreasing the viability.

Varieties did not differ greatly in the amount of damage sustained by the seed as a result of delayed harvesting.

It would appear that if cotton harvesting machines are to be used in the hill sections of the state they must harvest the cotton almost as cleanly as it is picked by hand. Otherwise, ginners will be obliged to install cleaning equipment not now necessary. If such cleaning equipment is installed hand labor can snap instead of pick and the machine will then be forced to compete with a hand method much more rapid than that now in use.

Effects of Delayed Harvesting by Picking and Snapping on Six Varieties of Cotton*

J. F. O'KELLY and W. W. HULL**

INTRODUCTION

As a rule, the cotton crop in the hill sections of Mississippi can be picked by available labor before any considerable amount of weather damage has occurred. However, in seasons when a normal to heavy yield coincides with labor scarcity growers cast about for a more rapid method of harvesting. Alternative methods at present may be the use of a more easily picked variety, snapping, and sledging. Since varietal choice and snapping appeared to hold most promise for the hill sections and since machines might respond to varietal differences, a project was started in which six varieties with contrasting boll types were picked and snapped on six dates at two to three week intervals. Data collected and presented here cover the harvesting rate as affected by variety, the two harvesting methods, delayed harvesting, and the quality and value of the lint and seed under the several conditions.

In planning and conducting this test it has been assumed that if mechanical harvesters come into general use they must harvest the cotton almost as cleanly as if it were hand picked, else gin operators will be obliged to install cleaning equipment. If such cleaning equipment is installed it will then be possible for hand labor to snap instead of pick. This will improve the competitive position of labor since cotton can be snapped much more rapidly than it can be picked.

In this report "snapping" is used to designate the act of pulling the entire opened boll from the plant which will, of course, include varying amounts of stem and leaf parts. "Picking" is the removal of the seed cotton with as little leaf and boll parts as possible.

MATERIALS AND METHODS

Material for the 1931 studies was provided by planting five varieties in blocks of approximately two acres each on the farm of Jennings Hardy about seven miles east of Artesia. The soil was a Houston clay and proved later to be poorly drained on one side of the field. This poor drainage caused a poor stand and loss of production on that side of the field. These irregularities caused some inconsistencies in the results. The varieties used in 1931 are designated as A, B, C, E, and F and are described below.

Variety	Boll Size	Staple	Lint percentage	Plant height and foliage
A	very small	1 1/8	32-34	Dwarf; light foliage
B	medium	1 3/16	31-33	Medium tall; medium foliage
C	medium	1	35-37	Tall; heavy foliage
D	medium-big	7/8-15/16	35-37	Tall; heavy foliage
E	medium	15/16	33-35	Tall; heavy foliage
F	small	1-1 1/16	33-35	Dwarf to medium; light foliage

In addition to these varieties the second and third years work included variety D. These plantings were on the station farm at State College on

*J. W. Randolph, Bureau of Agricultural Engineering, U. S. D. A. and T. N. Jones, Department of Agricultural Engineering, Mississippi Experiment Station, contributed many helpful suggestions in the organization of this project in 1931.

**Formerly Associate Agronomist.

Ocklocknee sandy loam. As in the previous year each variety was planted in a large block. Since the soil was more uniform the yields were more nearly comparable but it is well to state here that to determine the relative yielding ability of the several varieties was not one of the objectives. It was desired, however, to obtain normal yields with each variety in order that the effects of delayed harvesting on the rate of harvest and on the quality of lint and seed obtained from the several harvests would not be distorted.

Prior to harvest each variety block was divided into six parts to provide as many harvesting dates. The time of the first harvest was fixed by the date at which enough cotton was open to provide a satisfactory sample both as to amount of cotton and time required for the harvesting operations. This varied from September 13 to September 27. The interval from harvest to harvest, as planned, was two weeks in 1931 and three weeks in 1932 and 1933. Because of unfavorable weather the operations sometimes could not be performed on the exact date set and the sixth harvest in 1931 was delayed until the cotton was ruined by trespassing livestock.

In the fall of 1931 five laborers were used throughout the season except for one substitution on each of the last two harvesting dates. One laborer was assigned to each variety and did all of the picking and snapping for that date. At the next harvest date each laborer was assigned to another variety. Thus, except for the substitutions just noted, each laborer harvested each variety once during the season. This rotation improved the season averages for the varieties and made them more comparable. However, it probably made the data for each harvesting date less accurate within the variety since some of the laborers who were poor pickers were fair to good at snapping. The time at which each operation was begun and finished and the weight of cotton obtained was recorded. The samples so obtained were taken to the laboratory for further studies.

Some changes in field methods were made in the 1932 and 1933 seasons. Six laborers were used. Substitutions were few and as a rule, substitutes could be obtained with much the same characteristics as those being replaced. At each harvest three of these laborers were placed at one end of a plot and three at the other end. They would then snap or pick the plot as was required. The time consumed and the weight of cotton obtained were recorded. When both operations for any variety were completed the workers were taken to another. This was continued until all data for all varieties for that date had been obtained.

This method was open to the objection that some varieties were harvested early in the day while the workers were fresh and others were harvested late in the day while the workers might have been fatigued. Observations indicated that this difference was not great. The time required to finish a plot was not great and it appeared that the small interval of time required for emptying and weighing the cotton as each plot was finished prepared the workers for entering the next plot at the normal rate.

Harvesting was not begun at morning until practically all dew had evaporated. When each plot was finished the cotton was placed on a large canvas and mixed as thoroughly as possible. When the lot seemed a bit moist from dew it was allowed to sun until the next plot was harvested. Samples of twenty-five to thirty pounds were bagged and tagged for laboratory studies.

In the case of the first harvest and sometimes the second each season the cotton had not been open long enough to be thoroughly dry. Extra samples were saved in such cases and dried in the attic of the seedhouse for two to three weeks. It is drying of this type that is referred to in the data. The drying experiment was not planned to study the efficiency of mechanical driers nor the problems involved in harvesting cotton with varying amounts of moisture from dew and rain.

Seed cotton samples obtained from each harvesting were taken promptly to the laboratory. If any was to be dried the process was started. The other samples were then put through a Mitchell Extractor with a record of the weight before and after the cleaning process. The machine was run at normal speed and was set for "rough" cotton while the snapped material was being put through and for "smooth" cotton while the picked material was being put through. This operation resulted in a loss of twenty to thirty percent due to trash removed in the case of snapped cotton and one to five percent in the case of picked cotton. The loss due to trash removal increased noticeably in cotton obtained by both methods as the season advanced.

TABLE 1—POUNDS LINT HARVESTED PER LABORER
PER TEN HOUR DAY, 1931

Method of harvest	A	B	Variety			Average	Ratio snapping to picking
			C	E	F		
*First harvest September 22. Samples 3 and 4 dried.							
Snapped	108.6	84.0	85.8	102.6	100.8	96.4	1.45
Picked	62.4	76.2	90.0	59.4	45.0	66.6	
Snapped	106.8	84.6	85.2	103.2	100.2	96.0	1.44
Picked	62.4	76.2	91.2	58.8	45.0	66.7	
Second harvest, October 9. Samples 3 and 4 dried.							
Snapped	136.2	139.2	103.8	140.4	124.8	128.9	1.80
Picked	63.6	71.4	54.0	64.8	104.4	71.6	
Snapped	136.2	145.8	103.2	138.6	123.0	129.4	1.89
Picked	63.6	70.2	54.0	65.4	89.4	68.5	
Third harvest, October 21.							
Snapped	147.6	138.0	157.2	130.2	111.6	136.9	1.57
Picked	70.8	97.8	94.8	91.2	81.6	87.2	
Fourth harvest, November 3.							
Snapped	112.2	134.4	127.2	72.6	88.8	107.0	1.68
Picked	83.4	70.8	42.0	66.6	56.4	63.8	
Fifth harvest, November 23.							
Snapped	118.8	124.2	112.2	146.4	161.4	132.6	1.92
Picked	64.2	69.0	67.8	80.4	64.8	69.2	
Top harvest, October 21, from same plots as first harvest.							
Snapped	113.4	205.8	133.8	100.2	96.6	130.0	1.60
Picked	61.2	106.2	91.8	73.2	75.0	81.5	
Top harvest, November 23, from same plots as second harvest.							
Snapped	95.4	76.2	61.2	81.0	120.6	86.9	3.00
Picked	17.4	24.6	21.6	44.4	37.2	29.0	
Averages, each variety, all harvests.							
Snapped	119.5	125.8	107.7	112.8	114.2	116.0	1.72
Picked	61.0	73.6	67.5	67.1	66.5	67.1	
Ratio	1.96	1.71	1.59	1.68	1.72	1.73	

*In this and certain other tables and figures, first, second, third, fourth, fifth, and sixth harvests refer to separate plots while top harvest refers to cotton taken from plots where a harvest had been made before all the bolls were open.

After the cleaning process all seed cotton samples were ginned on a twenty-saw gin run at about 400 revolutions per minute with a moderately tight roll. Lint samples for classing were taken from the middle portion of each lot thus avoiding the lint obtained while the roll was being formed and that obtained after the roll had broken. Weights taken before and after ginning were the basis for lint percentage data.

The 1931 lint samples were classed as to grade and staple by Alabama Cooperative Cotton Association; Mississippi Cooperative Cotton Association; Bureau of Agricultural Economics, U. S. D. A.; F. P. Philips, Columbus, Miss.;

and Prof. J. P. Welborn, State College, Miss. The 1932 and 1933 samples were classed by S. T. Selden, Memphis; F. P. Philips, Columbus, Miss.; Mississippi Cooperative Cotton Association; M. M. Randle, New Orleans; and Prof. E. H. Bailey, State College, Miss.

Prices used in all cases were supplied by the Bureau of Agricultural Economics, U. S. D. A. That Bureau provided prices for the various grades and staples for each day of the marketing season. From these prices were tabulated the points on or off for the grade and staple of each sample as assigned by each classer. From these tabulations the average value per pound for each variety by each harvesting method and on each harvesting date was determined.

**TABLE 2—POUNDS LINT HARVESTED PER LABORER
PER TEN HOUR DAY, 1932**

Method of harvest	Variety						Ratio snapping to picking	
	A	B	C	D	E	F	Average	
First harvest, September 13. Samples 3 and 4 dried.								
Snapped	75.0	77.4	92.4	79.8	87.0	82.8	82.4	2.08
Picked	39.0	34.8	42.0	51.0	37.2	33.6	39.6	
Snapped	74.4	79.2	94.8	79.8	88.2	79.2	82.6	2.05
Picked	39.6	34.8	40.2	52.2	37.8	37.2	40.3	
Second harvest, October 3. Samples 3 and 4 dried.								
Snapped	87.0	84.0	99.0	110.4	100.2	87.6	94.7	2.94
Picked	23.4	28.2	34.8	40.8	36.6	29.4	32.2	
Snapped	80.4	80.4	91.8	96.0	102.0	86.4	89.5	2.79
Picked	24.0	23.4	34.8	44.4	37.2	28.8	32.1	
Third harvest, October 24.								
Snapped	79.2	94.2	98.4	111.0	103.2	106.8	98.8	3.41
Picked	21.0	28.2	32.4	38.4	28.8	25.2	29.0	
Fourth harvest, November 14.								
Snapped	85.2	108.6	133.8	124.8	115.2	122.4	115.0	3.98
Picked	19.8	27.6	34.2	33.6	28.2	30.0	28.9	
Fifth harvest, December 5.								
Snapped	160.2	139.2	162.6	165.0	156.0	153.0	156.0	5.29
Picked	22.8	25.2	36.0	40.2	27.0	25.8	29.5	
Sixth harvest, January 24.								
Snapped	112.8	182.4	166.2	145.2	166.2	131.4	150.7	4.24
Picked	28.2	37.8	42.0	37.8	32.4	30.0	34.7	
Top harvest, October 25. Same plots as first harvest.								
Snapped	66.6	75.6	84.6	88.2	85.2	76.2	79.4	2.61
Picked	22.2	28.8	33.0	43.2	29.4	25.8	30.4	
Averages, each variety, all harvests.								
Snapped	91.2	102.3	113.7	111.1	111.5	102.9	105.4	3.20
Picked	26.7	29.9	36.6	42.4	32.7	29.5	33.0	
Ratio	3.42	3.42	3.11	2.62	3.43	3.49	3.19	

RESULTS

EFFECT OF HARVESTING DATE AND VARIETY ON RATE

Tables 1, 2, and 3 give data on each variety for each harvest for the three years. They indicate the pounds of lint a laborer was able to obtain by the two methods under the conditions. The data in these tables are summarized in Table 4 and the 1932, 1933 and two year averages form the basis for the graphs in Figure 1. The cumulative rainfall by periods for each season is presented graphically in Figure 2 and should help in the interpretation of these and other results as well as the prices with which they are presented.

The snapping and picking curves are presented in Figure 1 as straight lines in order to indicate trends more clearly. The fluctuations from harvest

to harvest and between contrasting seasons are shown in Table 4 and other tables.

The rate at which lint cotton could be obtained by picking decreased in both 1932 and 1933 as the season advanced. This decrease can be attributed largely to decay of boll parts, making their removal from the seed cotton more difficult, and to decreasing temperatures.

The average rate at which lint cotton was obtained by snapping increased as the season advanced although the trend upward was very slight in 1933 when rainfall was very light. In this season the rate of harvest was rather high for the early harvests and decay of boll parts was not great enough to induce increases later.

Table 2 shows that the greatest ratios between snapping and picking occurred in 1932 and Figure 2 shows that the greatest rainfall was recorded in that season. The graphs show the rainfall to each harvesting date beginning two weeks before the first harvest. There was more rainfall by the second harvest in 1932 than during the entire harvesting seasons in 1931 and 1933.

**TABLE 3—POUNDS LINT HARVESTED PER LABORER
PER TEN HOUR DAY, 1933**

Method of harvest	Variety						Average	Ratio snapping to picking	
	A	B	C	D	E	F			
First harvest, September 27.		Samples 3 and 4 dried.							
Snapped	139.8	127.8	150.6	130.8	108.6	111.6	128.2	2.13	
Picked	51.6	54.0	75.0	67.2	60.6	52.2	60.1		
Snapped	135.6	127.2	156.0	129.6	107.4	112.2	128.0	2.11	
Picked	51.0	55.2	75.0	67.8	61.8	52.8	60.6		
Second harvest, October 18.									
Snapped	102.6	110.4	132.0	108.0	121.2	115.8	115.0	2.36	
Picked	45.0	46.8	53.4	54.6	51.6	41.4	48.8		
Third harvest, November 7.									
Snapped	127.2	146.4	172.2	145.8	145.2	130.8	144.6	2.76	
Picked	42.6	52.8	61.8	57.0	53.4	46.8	52.4		
Fourth harvest, November 27.									
Snapped	107.4	144.0	154.8	112.2	130.8	121.2	128.4	2.92	
Picked	39.6	48.0	48.6	49.2	42.0	36.6	44.0		
Fifth harvest, December 21.									
Snapped	123.6	132.6	145.8	126.0	118.2	140.4	131.1	2.99	
Picked	37.2	45.0	52.2	48.0	42.6	37.8	43.8		
Sixth harvest, January 10.									
Snapped	112.8	141.6	126.6	116.4	125.4	127.8	125.1	3.33	
Picked	30.6	38.4	40.8	46.8	35.4	33.6	37.6		
Top harvest, November 7.									
Snapped	94.2	132.0	130.8	112.8	122.4	141.6	122.3	2.73	
Picked	46.2	48.0	49.2	43.8	42.6	39.0	44.8		
Averages, each variety, all harvests.									
Snapped	117.9	132.8	146.1	122.7	122.4	125.2	127.8	2.61	
Picked	43.0	48.5	57.0	54.3	48.8	42.5	49.0		
Ratio	2.74	2.74	2.56	2.26	2.51	2.95	2.61		

The significance of the foregoing can be appraised more readily by a further study of the ratios between snapping and picking. These ratios show as an average for six varieties, for all harvests, for two years, that lint cotton was obtained by snapping 2.11 times as fast as by picking early in the season and this increased to 3.91 times as fast by the last harvest. This would mean that after the first of December as much cotton can be obtained in ten days by snapping as in thirty days by picking, and as a rule, at that season of the year days when soil and atmospheric conditions are satisfactory for cotton picking are relatively few.

**TABLE 4—AVERAGE POUNDS LINT HARVESTED PER LABORER
PER TEN HOUR DAY**

No. of harvest All varieties	Method of harvest	Year					
		1931	1932	1933	1932-33	1931-33	
1	snapped	96.4	82.4	128.2	105.3	102.3	
	picked	66.6	39.6	60.1	49.9	55.4	
	ratio	1.45	2.08	2.13	2.11	1.85	
2	snapped	128.9	94.7	115.0	104.9	102.9	
	picked	71.6	32.2	48.8	40.5	50.9	
	ratio	1.80	2.94	2.36	2.59	2.02	
3	snapped	136.9	98.9	144.6	121.7	126.8	
	picked	87.2	29.0	52.4	40.7	56.2	
	ratio	1.57	3.41	2.76	2.99	2.26	
4	snapped	107.0	115.0	128.4	121.7	116.8	
	picked	63.8	28.9	44.0	36.5	45.6	
	ratio	1.68	3.98	2.92	3.33	2.56	
5	snapped	132.6	156.0	131.1	143.6	139.9	
	picked	69.2	29.5	43.8	36.7	47.5	
	ratio	1.92	5.29	2.99	3.91	2.95	
6	snapped		150.7	125.1	137.9		
	picked		34.7	37.6	36.2		
	ratio		4.34	3.33	3.81		
							*Rate of harvest index
Variety—all harvests							
A	snapped	119.5	91.2	117.9	104.6	109.5	100
	picked	61.0	26.7	43.0	34.9	43.6	100
	ratio	1.96	3.42	2.74	3.00	2.51	
B	snapped	125.8	102.3	132.8	117.6	120.3	112
	picked	73.6	29.9	48.5	39.2	50.7	112
	ratio	1.71	3.42	2.74	3.00	2.37	
C	snapped	107.7	113.7	146.1	129.9	122.5	124
	picked	67.5	36.6	57.0	46.8	53.7	134
	ratio	1.59	3.11	2.56	2.78	2.28	
D	snapped		111.1	122.7	116.9		112
	picked		42.4	54.3	48.3		138
	ratio		2.62	2.26	2.42		
E	snapped	112.8	111.5	122.4	116.9	115.6	112
	picked	67.1	32.7	48.8	40.8	49.5	117
	ratio	1.68	3.43	2.51	2.87	2.34	
F	snapped	114.2	102.9	125.2	114.1	114.1	109
	picked	66.5	29.5	42.5	36.0	46.2	103
	ratio	1.72	3.49	2.95	3.17	2.47	

*Based on two year average.

The effect of variety on the average rate at which cotton can be harvested is shown in Table 4. When the rate at which variety A was picked is taken as 100 it will be observed that the other varieties can be picked at a faster rate and the difference varies closely with increases in boll size.* The big boll types can be snapped more rapidly also but the differences are not so great. These efficiency ratings are discussed more fully in connection with yield per acre and rate of harvest.

*These results agree with HALE, G. A., *Fruiting Characters and Time and Cost of Picking Cotton Varieties*, Journal American Society of Agronomy, Volume 26:1, 1934.

LINT COTTON YIELDS

Tables 5, 6, 7, and 8 present the yields for all varieties, for all tests, for all harvests, by the two methods with difference, if any, in yield for snapping compared to picking. Variety D was in the tests for only two years and the sixth harvest was possible only in the same two years. Since the varieties were planted in blocks instead of small plots with several replications, the yields given do not show the relative productivity of the varieties and should not be used to determine which variety was superior from the yield standpoint.

TABLE 5—POUNDS LINT PER ACRE, 1931

Method of harvest	Variety					Average	Snapped less picked
	A	B	C	E	F		
First harvest, September 22.	Samples 3 and 4 dried.						
Snapped	313	176	136	73	121	163.8	25.6
Picked	263	168	125	58	77	138.2	
Snapped	307	178	135	73	121	162.8	24.2
Picked	263	168	127	58	77	138.6	
Second harvest, October 9.	Samples 3 and 4 dried.						
Snapped	440	335	291	248	324	327.6	-8.8
Picked	445	304	310	228	395	336.4	
Snapped	441	349	289	245	321	329.0	4.3
Picked	445	301	309	230	339	324.8	
Third harvest, October 21.							
Snapped	462	304	304	199	342	322.2	-10.4
Picked	429	413	304	212	305	332.6	
Fourth harvest, November 3.							
Snapped	428	314	356	296	321	343.0	-16.0
Picked	463	362	310	275	385	359.0	
Fifth harvest, November 23.							
Snapped	515	414	338	205	302	354.8	8.8
Picked	488	289	365	246	342	346.0	
Top harvest, October 21.	Same plots as first harvest.						
Snapped	205	220	165	134	199	184.6	23.2
Picked	161	173	163	134	176	161.4	
Top harvest, November 23.	Same plots as second harvest.						
Snapped	57	66	45	86	48	60.4	13.4
Picked	42	60	51	47	35	47.0	
Averages, all harvests.							
Snapped	452.6	336.6	294.1	222.7	299.9	321.2	9.2
Picked	428.4	319.7	294.9	212.6	304.4	312.0	

The data do show, however, the relative quantities of cotton with which the workers were confronted. They show that variety A had the greatest yield, variety C was second, variety F was third, variety E was fourth, and variety B was fifth. By referring to Table 4 it will be found that in snapping efficiency based on 1932-33 data, with variety A as 100, variety C had a value of 124, varieties B, D, and E 112, and variety F 109. In picking efficiency with variety A as 100, variety D had a value of 138, variety C 134, variety E 117, variety B 112, and variety F 103. These efficiency values closely parallel boll size, that is, the larger the boll the higher the rating. Boll sizes are given under materials and methods. The comparisons seem to indicate that the harvesting efficiency of the workers was not affected materially by the amount of cotton on a given area and that the chief differences in the harvesting efficiency of workers with these yields was due to varietal characteristics.

TABLE 6—POUNDS LINT PER ACRE, 1932

Method of harvest	Variety						Average	Snapped less picked
	A	B	C	D	E	F		
First harvest, September 13.	Samples 3 and 4 dried.							
Snapped	409.0	316.1	402.2	305.2	321.8	464.6	369.8	54.9
Picked	403.8	242.6	351.7	278.9	276.1	336.0	314.9	
Snapped	407.3	323.3	410.6	305.0	325.8	444.9	369.5	48.0
Picked	410.4	241.9	336.3	286.9	278.0	375.2	321.5	
Second harvest, October 3.	Samples 3 and 4 dried.							
Snapped	449.4	363.9	492.8	436.4	383.3	478.8	434.1	70.3
Picked	350.8	296.8	384.9	346.0	365.7	438.8	363.8	
Snapped	415.5	350.2	457.9	379.5	389.4	472.3	410.8	52.4
Picked	359.0	242.6	382.9	373.9	367.5	424.2	358.4	
Third harvest, October 24.								
Snapped	383.5	360.1	376.3	424.9	395.4	476.4	402.8	39.1
Picked	337.3	325.8	379.1	356.9	353.6	429.2	363.7	
Fourth harvest, November 14.								
Snapped	414.4	345.8	484.2	345.2	440.5	493.9	420.7	78.6
Picked	302.5	292.1	403.4	309.0	347.8	397.5	342.1	
Fifth harvest, December 5.								
Snapped	353.4	326.9	484.0	352.0	432.1	488.2	406.1	81.7
Picked	320.0	254.1	363.6	338.7	291.8	378.3	324.4	
Sixth harvest, January 24.								
Snapped	315.5	492.4	546.9	434.7	449.2	393.9	438.8	78.4
Picked	260.1	385.1	448.8	360.6	385.2	322.6	360.4	
Top harvest, October 25. Same plots as first harvest.								
Snapped	26.5	38.7	42.9	50.7	48.7	53.5	43.5	7.7
Picked	17.7	31.0	31.7	46.6	41.0	46.6	35.8	
Averages, all harvests.								
Snapped	396.8	364.7	462.2	379.2	398.3	470.8		
Picked	345.2	289.0	385.3	337.2	338.3	393.6		

TABLE 7—POUNDS LINT PER ACRE, 1933

Method of harvest	Variety						Average	Snapped less picked
	A	B	C	D	E	F		
First harvest, September 27.	Samples 3 and 4 dried.							
Snapped	317.8	103.8	292.1	127.1	175.9	199.1	202.6	33.2
Picked	233.3	114.4	217.9	98.0	166.7	186.3	169.4	
Snapped	308.6	103.4	303.8	125.6	173.6	199.8	202.5	32.1
Picked	232.8	115.8	218.3	98.9	169.4	187.0	170.4	
Second harvest, October 18.								
Snapped	381.5	250.5	342.2	175.0	255.5	299.3	284.0	22.9
Picked	348.7	189.3	285.3	177.7	282.8	282.6	261.1	
Third harvest, November 7.								
Snapped	413.1	261.1	362.3	212.2	329.5	358.7	322.8	37.8
Picked	367.1	222.8	350.1	193.7	303.5	272.5	285.0	
Fourth harvest, November 27.								
Snapped	331.1	256.1	326.1	199.7	296.1	313.3	287.1	44.0
Picked	288.0	200.8	299.4	151.1	271.7	247.4	243.1	
Fifth harvest, December 21.								
Snapped	380.9	214.2	330.5	183.4	268.3	249.9	271.2	41.1
Picked	285.1	175.4	253.3	171.7	276.1	219.1	230.1	
Sixth harvest, January 10.								
Snapped	347.8	206.3	306.5	151.2	223.1	269.1	250.7	31.2
Picked	272.2	192.3	252.6	165.6	211.5	222.8	219.5	
Top harvest, November 7. Same plots as first harvest.								
Snapped	76.2	128.3	169.1	91.1	119.3	137.7	120.3	19.4
Picked	67.2	101.4	134.8	78.6	109.8	113.3	100.9	
Averages, all harvests.								
Snapped	365.3	217.7	347.5	180.8	263.0	289.6	277.3	37.4
Picked	299.2	187.5	287.4	162.2	255.9	247.3	239.9	

The assumption just made is supported by the results of the top harvests. Each year some of the cotton was not open when the first harvest was made and in 1931 some opened after the second harvest. This cotton is referred to as "top" crop or harvest. The first and second top harvests in 1931 were obtained from the same plots as the first and second regular harvests respectively. Although the per acre yields of all these top harvests were low, as shown in Tables 5, 6, and 7, the efficiency of the workers was not lowered materially, as shown in Tables 1, 2, and 3, except in the case of the second top harvest in 1931. These data indicate that with workers of this type the per acre yields must be reduced very considerably before the excessive amount of travel required lowers the efficiency of the worker's hands.

TABLE 8—AVERAGE POUNDS LINT PER ACRE, 1931-33

Method of harvest	Variety						Average all varieties
	A	B	C	*D	E	F	
First harvest							
Snapped	343	200	280	215	191	258	248
Picked	300	175	228	150	168	207	205
Difference	43	25	52	65	23	51	43
Second harvest							
Snapped	414	316	369	291	296	351	339
Picked	383	254	326	269	293	360	314
Difference	31	62	43	22	3	-9	25
Third harvest							
Snapped	414	308	347	318	308	392	348
Picked	378	287	344	275	290	335	318
Difference	36	21	3	43	18	57	30
Fourth harvest							
Snapped	391	305	389	272	344	376	346
Picked	351	285	337	230	298	343	307
Difference	40	20	52	42	46	33	39
Fifth harvest							
Snapped	416	285	384	267	302	347	333
Picked	364	273	343	255	271	313	303
Difference	52	12	41	12	31	34	30
**Sixth harvest							
Snapped	331	288	426	293	336	331	334
Picked	266	288	351	263	298	273	290
Difference	65	0	75	30	38	58	44
Averages, all harvests							
Snapped	385	284	366	276	296	342	325
Picked	340	260	321	240	270	305	289
Difference	45	24	45	36	26	37	36

*Variety D was not in 1931 tests.

**Sixth harvest was not made in 1931.

It appears, therefore, the rate at which cotton can be picked may vary as much as thirty-five percent, the increase varying largely with the boll size. The data indicate further that cotton of a given variety may be harvested one and a half to four times as rapidly by snapping as by picking, the ratio varying largely with the amount of weather damage sustained by the boll parts.

The yield data, Table 8, show rather clearly that the yield per acre is increased twenty-five to forty-five pounds to the acre by snapping as compared to picking. This difference is due, of course, largely to the increased amounts of leaf, boll parts, pieces of stems, etc. The effect of these increases in conjunction with prices will be considered later.

ACRE VALUE OF LINT

After the lint samples had been classed and prices obtained as indicated the points "on" or "off" for grade and staple were computed. These data were used to compute the acre values for lint as shown in Table 9, and in connection with rainfall data to construct Figure 2.

TABLE 9—DOLLARS PER ACRE FOR LINT 1931, 1932 AND 1933

Method of harvest	Variety						Average all varieties
	A	B	C	D	E	F	
First harvest							
Snapped	25.79	15.68	21.11	15.87	14.11	18.66	18.54
Picked	25.67	15.45	19.07	15.57	14.04	17.79	17.93
Gain or loss.....	.12	.23	2.04	.30	.07	.87	.61
Second harvest							
Snapped	27.21	21.98	24.42	20.12	19.09	24.04	22.81
Picked	29.27	20.23	24.30	20.56	21.95	26.99	23.88
Gain or loss.....	-2.06	1.75	.12	-.44	-2.86	-2.95	-1.07
Third harvest							
Snapped	27.22	21.03	23.01	20.11	20.03	25.89	22.88
Picked	29.52	24.70	25.95	19.35	21.08	24.52	24.18
Gain or loss.....	-2.30	-3.67	-2.93	.76	-1.05	1.37	-1.30
Fourth harvest							
Snapped	25.84	21.10	25.74	18.56	22.77	25.95	23.33
Picked	26.83	22.96	24.73	16.56	21.63	25.64	23.06
Gain or loss.....	-.99	-1.86	1.01	2.00	1.14	.31	.27
Fifth harvest							
Snapped	24.96	19.37	22.14	15.92	16.88	19.33	19.77
Picked	25.35	16.98	21.44	16.36	18.30	20.74	19.86
Gain or loss.....	-.39	2.39	.70	-.44	-1.42	-1.41	-.09
Sixth harvest							
Snapped	23.37	22.53	28.90	18.45	21.83	23.42	23.08
Picked	21.79	22.33	25.73	18.01	21.35	21.44	21.77
Gain or loss.....	1.58	.20	3.17	.44	.48	1.98	1.31

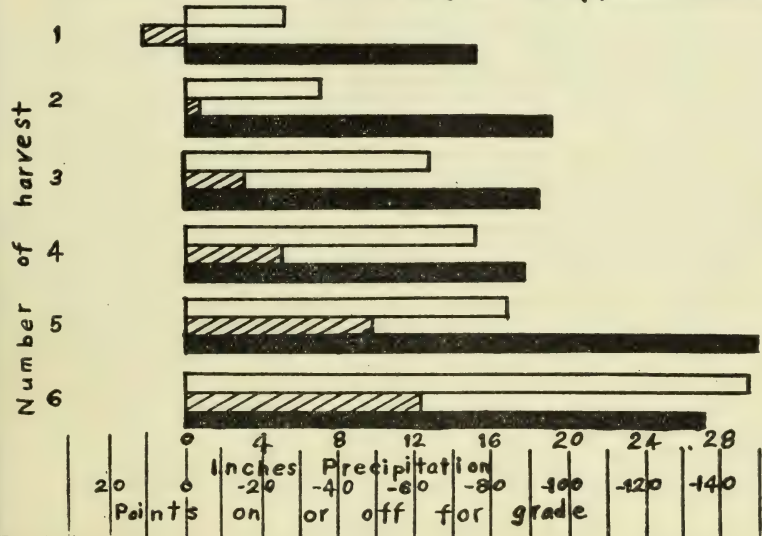
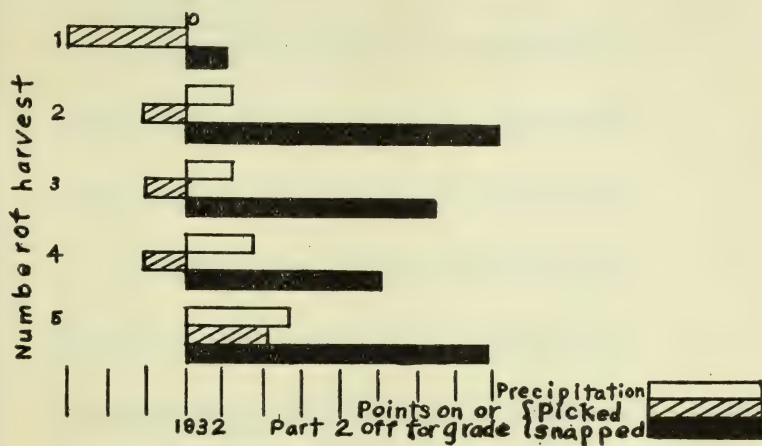
Figure 2 indicates the points on or off for the average of all varieties at each harvesting date and the inches of rainfall to each harvest beginning two weeks before the first harvest. There was no rainfall two weeks before the first harvest in 1931 and the amount for the season was not great. In 1933 rains started between the second and third harvests but did not become heavy by the last harvest. Conditions in 1932 were quite different. The amount of rainfall to the first harvest was more than four inches and by the second harvest the amount was seven inches which was more than the amount to the last harvest in each of the other two years.

The grades assigned by the classers became lower as the season advanced and precipitation increased. The price variations for the picked samples closely paralleled the rainfall data. Premiums for grade decreased and discounts increased as the cotton was subjected to increasing amounts of rainfall.

Price trends for the snapped samples did not show any considerable tendency to vary as the rainfall varied. This may be accounted for in part by the fact that the demand for low grade cotton fluctuates from season to season and within the same season, and to the probability that some of the classers, not being thoroughly familiar with snapped cotton, may have sometimes been at a loss as to the merits of some of the samples.

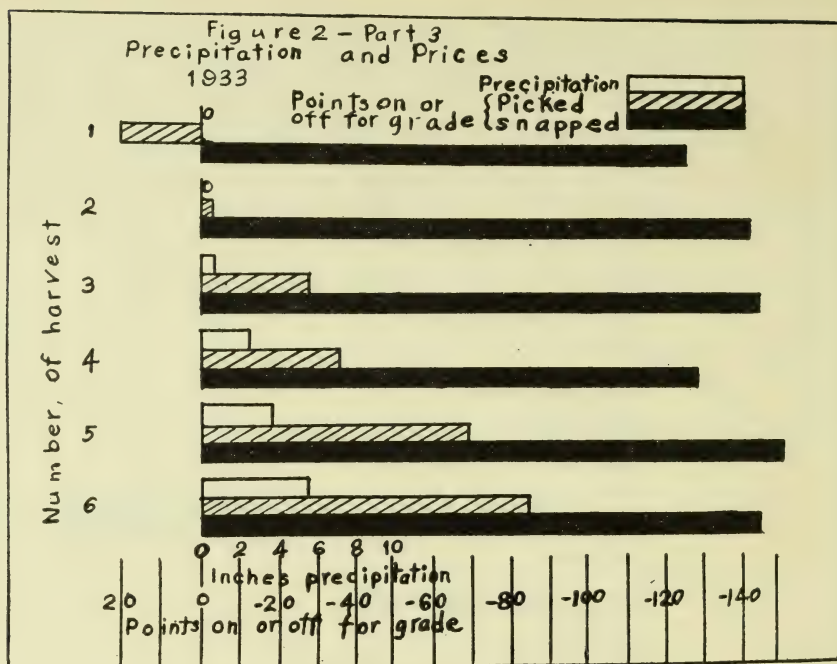
It was pointed out in the discussion of lint yields that the total pounds harvested by snapping was greater than by picking. This difference partly offset the reduction in value because of a lower grade. It would doubtless be erroneous, however, to assume that if snapping should become general the

Figure 2 Part 1
Precipitation and Prices
1931



same yield-price relation would obtain, for with the general adoption of snapping the supply of such cotton would exceed the demand and the reduced supply of picked cotton would not be adequate. The result would be a widening of the price differential and a consequent material loss in the acre value of lint harvested by snapping.

The average values given in Table 9 do not cover a sufficiently long period to give a conclusive idea of the price differential for snapped and picked cotton. It is felt, however, that fluctuations in demand for such cotton and fluctuations in supplies of all kinds from season to season and within the same season, together with fluctuations in the general price level and other variables would require price averages covering a period of many years to make them dependable. And at the end of that period the industrial demands could be so changed that the data would be of doubtful value. The values are given,



therefore, for what they may be worth, with the suggestion that more emphasis should be placed on other phases of the report.

As previously indicated some seed cotton samples from the first harvest each year and from the second harvest two years were dried in the attic of the seedhouse. This drying improved the grade in practically every case, the average differences varying from four to thirteen points. This would be equivalent to twenty to sixty-five cents a bale. Gains no greater than these could hardly justify the practice if any outlay for labor and overhead were required. Such drying would doubtless improve the keeping qualities of seed with a high moisture content if it were necessary to bulk them. As these seed were handled drying did not affect the quality. Values for dried samples are not reported.

These statements in regard to drying, of course, have no reference to mechanical driers used for drying seed cotton moist with dew or rain.

SEED STUDIES

Seed samples of varieties D and F, differing widely in boll size and ease of harvest, were saved from the 1932 and 1933 harvests. These were analyzed chemically, certain oil constants were obtained, and germination tests were made. Standard chemical methods were used and percentage data are based on a uniform moisture content of seven percent.*

*Analytical work on seed was done by M. Geiger, Station Chemist.

Some of the chemical data are given in Table 10. It will be observed that the average gallons of oil per ton for the sixth harvest, 1932, season, was considerably higher than for other harvests. This was caused by the higher oil percentage which, in turn, was caused by excessive weather damage. Rainfall was so great that other constituents of the seed, such as carbohydrates were broken down, thus changing the proportions. Figure 3 shows the contrast in rainfall for the two seasons and should be considered in connection with the data just mentioned.

TABLE 10—SEED ANALYSES AND CHARACTERISTICS OF OIL

Variety	Year	Number of harvests					
		1	2	3	4	5	6
Gallons of oil per ton of seed							
D	1932	47.56	46.56	48.20	46.02	48.94	51.19
F	1932	45.88	46.00	44.82	45.24	44.71	48.04
Average	1932	46.62	46.28	46.51	45.61	46.83	49.62
D	1933	53.49	53.32	53.64	54.07	54.49	54.23
F	1933	52.48	53.67	52.65	52.95	52.97	53.43
Average	1933	52.99	53.50	53.15	53.51	53.73	53.83
Oil percentage							
D	1932	17.75	17.46	18.08	17.26	18.36	19.20
F	1932	17.21	17.25	16.88	16.97	16.77	18.02
Average	1932	17.48	17.35	17.48	17.12	17.57	18.61
D	1933	20.06	20.00	20.12	20.28	20.44	20.34
F	1933	19.68	20.13	19.75	19.86	19.87	20.04
Average	1933	19.87	20.07	19.99	20.07	20.16	20.19
Nitrogen percentage							
D	1932	3.59	3.67	3.67	3.84	3.68	3.77
F	1932	3.58	3.52	3.53	3.58	3.55	3.56
Average	1932	3.58	3.60	3.60	3.71	3.62	3.67
D	1933	3.35	3.57	3.43	3.49	3.49	3.48
F	1933	3.29	3.45	3.37	3.35	3.40	3.33
Average	1933	3.32	3.51	3.40	3.42	3.45	3.41
Percentage of free fatty acids							
D	1933	0.62	0.46	0.71	1.10	1.85	3.27
F	1933	0.86	0.98	1.05	1.54	1.84	2.93
Iodine absorption number							
D	1932	107.20	108.14	108.80	108.20	106.20	108.20
F	1932	110.40	110.06	110.70	109.40	108.80	108.20
Average	1932	108.80	109.10	109.75	108.80	107.50	108.20
D	1933	110.54	112.18	109.55	109.55	109.55	109.55
F	1933	111.85	113.50	110.54	110.87	111.53	106.26
Average	1933	111.20	112.84	110.13	110.21	110.54	107.91
Saponification number							
D	1932	199.5	201.6	198.7	198.7	194.6	195.5
F	1932	199.3	200.2	194.9	196.0	195.9	194.0
Average	1932	199.4	200.9	196.5	197.4	195.3	194.8
D	1933	190.3	192.2	193.1	191.2	192.3	192.1
F	1933	192.9	192.8	193.2	194.0	192.9	194.2
Average	1933	191.6	192.3	193.2	192.6	192.6	193.2

That the quality of the oil deteriorated as weather damage increased is most strikingly shown by the data on free fatty acids shown in Table 10. They increased consistently as the season advanced although the samples were from the 1933 harvests when rainfall was not heavy. The saponification number declined as weather damage increased in the 1932 season when rainfall was excessive but it showed no material trend during the 1933 season. The iodine absorption number showed no distinct trend either year.

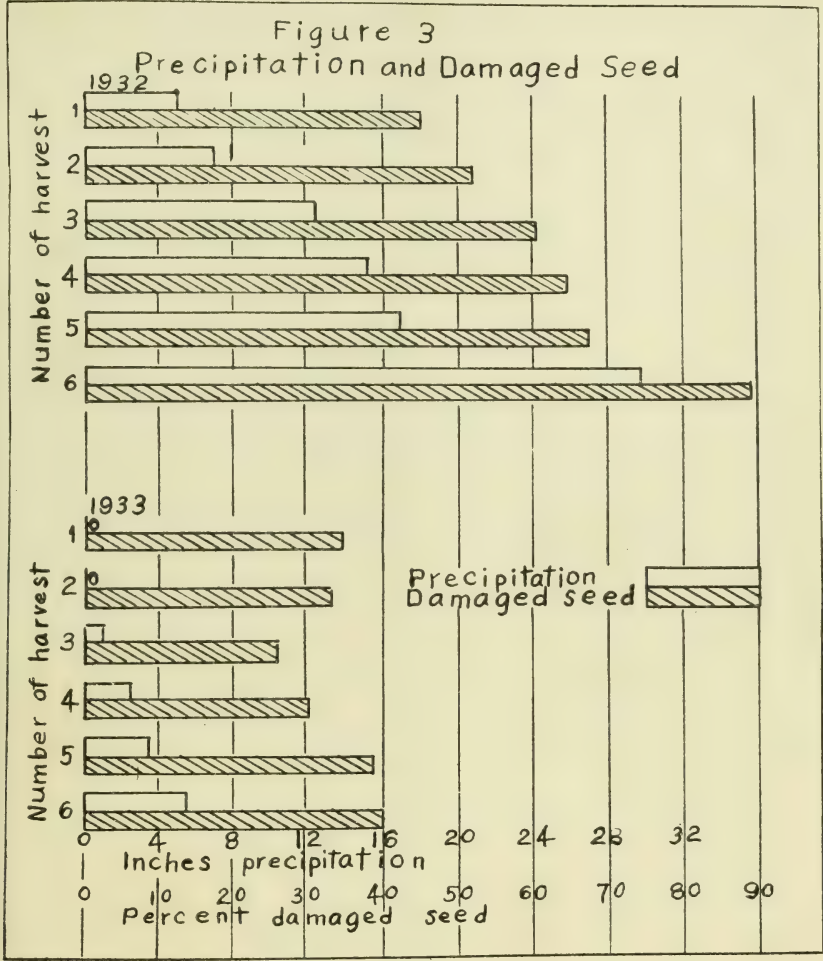
TABLE 11—GERMINATION COUNTS, 1932

Method of harvest	Variety						Average
	A	B	C	D	E	F	
First harvest, September 3. Samples 3 and 4 dried.							
Snapped _____	56	49	55	63	47	57	55
Picked _____	64	39	55	61	49	58	54
Snapped _____	56	57	59	61	34	53	53
Picked _____	66	52	54	67	41	43	54
Second harvest, October 3. Samples 3 and 4 dried.							
Snapped _____	49	40	60	49	32	45	46
Picked _____	46	43	42	59	49	42	47
Snapped _____	38	32	54	60	45	53	47
Picked _____	47	44	51	55	51	52	50
Third harvest, October 24.							
Snapped _____	38	29	41	54	37	39	40
Picked _____	36	35	33	52	37	42	39
Fourth harvest, November 14.							
Snapped _____	32	21	44	41	32	42	35
Picked _____	31	28	43	36	36	42	36
Fifth harvest, December 5.							
Snapped _____	24	37	30	33	34	48	34
Picked _____	31	21	37	39	29	37	32
Sixth harvest, January 24.							
Snapped _____	7	5	16	15	8	11	10
Picked _____	5	10	15	14	9	16	12
Top harvest, October 25.							
Snapped _____	55	37	55	50	44	55	49
Picked _____	59	51	52	54	39	59	52
Averages.							
Snapped _____	39	34	46	47	35	45	41
Picked _____	43	36	42	49	38	43	42

TABLE 12—GERMINATION COUNTS, 1933

Method of harvest	Variety						Average
	A	B	C	D	E	F	
First harvest, September 27. Samples 3 and 4 dried.							
Snapped	67	72	73	78	67	58	69
Picked	56	66	55	67	66	62	62
Snapped	67	67	67	57	55	74	65
Picked	48	65	73	81	54	63	64
Second harvest, October 18.							
Snapped	73	67	81	55	78	58	69
Picked	80	51	58	71	77	51	65
Third harvest, November 7.							
Snapped	65	54	86	64	63	69	67
Picked	70	78	81	85	86	81	80
Fourth harvest, November 27.							
Snapped	78	81	52	69	88	62	72
Picked	76	73	62	52	68	70	67
Fifth harvest, December 21.							
Snapped	31	67	65	62	69	63	60
Picked	55	63	60	73	71	57	63
Sixth harvest, January 10.							
Snapped	54	73	72	64	50	60	62
Picked	32	69	65	58	59	65	58
Top harvest, November 7.							
Snapped	79	66	78	64	59	71	70
Picked	72	72	55	67	66	80	69
Averages.							
Snapped	64	68	72	64	66	64	67
Picked	61	67	64	69	68	66	66

Seed from the 1932 and 1933 harvests were tested for viability. Tables 11 and 12 give the results and Figure 3 shows how the percentage of damaged seed increased as the amount of rainfall to date of harvest increased in 1932. In 1933 when the rainfall was not great the increase in damaged seed was not so marked. The term "damaged" seed as used here indicates seed which did not germinate.



The germination percentages, Tables 11 and 12, were a little higher for those varieties most easily harvested, as indicated by the efficiency ratings in Table 4 but the differences were not great enough to be of practical value.

**A Compilation of
Experimental and Other
Data on**

**FEEDING
COTTONSEED PRODUCTS
TO BEEF CATTLE**

Compiled Under the Direction of

C. F. CLARK
Coordinator Research Information

Jointly Representing
Mississippi Agricultural Experiment Station
and
Mississippi State Vocational Board

J. R. Ricks, Director
Mississippi Agricultural Experiment Station
State College, Mississippi

FEEDING COTTONSEED PRODUCTS TO BEEF CATTLE

FOREWORD

The need for a compilation of experimental data relating to cottonseed feed products has been expressed by a great many agricultural workers. This is the first of a series of bulletins dealing with the feeding of cottonseed products to various types of livestock. Since cottonseed meal is one of our most widely used protein feeds it is felt that these publications will meet a definite need in determining the place that cottonseed products should fill in the feeding of livestock.

This bulletin reports certain phases of one of the cooperative studies undertaken in the Project in Research in Universities of the Office of Education. The study is financed under the Emergency Relief Appropriation Act of 1935. Mr. W. A. Ross, Specialist in Subject Matter, U. S. Office of Education, is the Study Coordinator.

This bulletin on, "Feeding Cottonseed Products to Beef Cattle", was compiled under the direct supervision of Mr. O. L. Snowden, now connected with the Agricultural Education Department of Mississippi State College. Mr. Snowden was responsible for compiling parts of all bulletins of this series but this one he is entirely responsible for.

Appreciation is due Mr. H. H. Leveck, Assistant in Animal Husbandry, Mississippi State College, for suggestions in regard to the manuscript and in regard to the index.

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INTRODUCTORY DISCUSSION OF COTTONSEED PRODUCTS AS A LIVESTOCK FEED

VALUE OF COTTONSEED PRODUCTS AS LIVESTOCK FEEDS

Cottonseed Products have been used extensively for stock feeding in the South for many years. During more recent times their use has become general in many sections outside the Cotton Belt. The demand from foreign countries is strong, despite the fact that these products cost considerably more there than they do in this country. European feeders, as a rule, have placed more value on high-protein feeds than the average American livestock man.

Another reason why cottonseed products are of such great importance, in addition to their high-protein content, is their immense production. Although the production of cotton has shown a slight decrease during the last ten years, the decrease has not been so marked as has been the case with flaxseed, from which linseed meal* is made. Several new protein feeds, like peanut cake, copra cake, and fish meal, have been offered on the market during the last few years, but with the average stockman they have not been received with so much favor as cottonseed meal or linseed meal, due in part to their unknown value. These newer products, however, have some characteristics that are making them of value in livestock feeding.

*This product is also known as "oil meal", and "new process" meal and "old process" meal.

COMPOSITION OF COTTONSEED PRODUCTS

There are a large number of cottonseed products used as livestock feeds. Both concentrates and roughages are included. All the concentrate products have the same general characteristics and qualities, their chemical composition depending mainly upon the form of manufacture and the thoroughness in separating the hulls. Among the more common cottonseed products used as feeds are cottonseed, cottonseed meal and cake, and cottonseed hulls. Table I gives analyses representing these products, which have been put on the market by manufacturers to conform to the definitions adopted by the Association of Feed Control Officials of the United States.

Table 1—Composition of Cottonseed Products†
(Pounds of nutrients in 100 Pounds)

	Water	Ash	Crude Protein	Carbohydrates Fiber	Nitrogen free extract	Fat (ether extract)
	%	%	%	%	%	%
Cottonseed	9.1	4.0	19.6	18.9	28.3	20.1
Cottonseed meal and cake:						
41 per cent protein.....	7.1	5.7	41.7	10.0	28.4	7.1
38.6 per cent protein.....	6.9	5.9	38.8	12.2	29.4	6.8
36 per cent protein.....	7.3	5.8	36.8	13.5	30.0	6.6
Cold-pressed cottonseed	6.9	4.2	27.5	24.2	30.2	7.0
Cottonseed hulls	8.7	2.6	3.5	46.2	38.0	1.0

†Furnished by the Bureau of Chemistry, United States Department of Agriculture.

GRADES AND CLASSES OF COTTONSEED PRODUCTS

Formerly cottonseed (uncrushed) was used quite extensively as a feed for livestock. Its value as a source of cottonseed oil and its utilization for commercial purposes has greatly decreased the amount fed in the form of seed. Cottonseed products have taken the place of the seed as a feedstuff. Several feeding tests have indicated that 1 pound of good-quality cottonseed meal is equal to nearly 2 pounds of cottonseed as a feed for fattening steers. Large rations of cottonseed tend to produce scours, but when used in quantities up to 5 or 6 pounds there is little or no trouble from this source.

Cottonseed contains about 20 per cent each of fat or oil and crude protein. Compared with a good grade of cottonseed meal it contains about half as much protein and about three times the content of oil.

A ton of cottonseed will yield approximately the following quantities of products:‡

	Pounds
Linters or short fiber	110
Hulls	514
Cake or meal	954
Crude oil	303
Dirt and loss in manufacture	119
Total	2,000

‡Average for the five years 1914-15 to 1918-19 as compiled by the Bureau of Markets, United States Department of Agriculture, from Bureau of Census figures and estimates.

Cottonseed cake is made from the residue which remains after the oil has been extracted from the seed. Ordinarily the greater part of the hull is removed before the oil is extracted. When this is done the amount of crude fiber in the resulting cake is proportionately smaller. The hulled kernels are crushed, heated, and subjected to great pressure to remove the oil. The residue when of prime quality should be a hard, boardlike cake of a yellowish color. The color is often an indication of the quality. The presence of hulls gives the cake a dark appearance. A dark color may also be caused by overheating during the pressing process or by fermentation, each of which lessens the feeding value.

Cottonseed cake and cottonseed meal are practically one and the same thing; that is, the meal is the cake in a ground form. The meal is most commonly used, but the cake has the distinct advantage in certain cases. European buyers show a preference for the cake for the reasons that there is less loss in handling, it is easier to judge the quality, and because the cake is better adapted for feeding alone or on the ground. Ocean freight rates also are lower for the cake than the meal.

In the United States the cake is preferred by men who feed their cattle in the open where the wind may blow the meal away. On the range or pasture the cake is often broken up and fed in troughs or spread upon the ground. If meal was used, the loss in feeding in this manner would be very large.

There are many grades and classes of cottonseed products sold on the market. The grades as classified and described by the Association of Feed Control Officials of the United States are as follows:

Cottonseed meal is a product of the cottonseed only, composed principally of the kernel with such portion of the hull as is necessary in the manufacture of oil, provided that nothing shall be recognized as cottonseed meal that does not conform to the foregoing definition and that does not contain at least 36 per cent of protein. Cottonseed meal shall be graded and classed as follows:

1. **Cottonseed meal, prime quality.** Cottonseed meal, prime quality, must be finely ground, not necessarily bolted, of sweet odor, reasonably bright in color, yellowish not brown or reddish, free from excessive lint, and shall contain not less than 36 per cent of protein. It shall be designated and sold according to its protein content. Cottonseed meal, with 36 per cent of protein shall be termed "36 per cent protein cottonseed meal, prime quality," and higher grades similarly designated (as "43 per cent protein cottonseed meal, prime quality"), etc.

2. **Cottonseed meal, off quality.** Cottonseed meal not fulfilling the above requirements as to color, odor, and texture shall be graded "36 per cent protein cottonseed, off quality," and higher grades similarly designated.

Cottonseed feed is a mixture of cottonseed meal and cottonseed hulls, containing less than 36 per cent of protein.

Cold pressed cottonseed is the product obtained from the subjection of the whole undecorticated cottonseed to the cold-pressure process for the extraction of oil and includes the entire cottonseed less the oil extracted.

Ground cold-pressed cottonseed is the product obtained by grinding cold-pressed cottonseed.

Cottonseed hulls are the roughage product of the cottonseed-oil manufacture. The hulls are removed from the cottonseed before the oil is extracted. They have a very low-protein content and should be fed only in connection with protein-rich feeds. As a roughage the hulls have a lower feeding value than oat straw or corn stover, but are valuable where no other roughage is available. This product is used extensively in the South, especially for steer feeding.

Cottonseed hull bran is ground cottonseed hulls from which the lint has been removed. The feeding value of the bran is not appreciably greater than that of ordinary cottonseed hulls.

Reference: U. S. D. A. Farmer's Bulletin 1179, pages 1, 2 and 3, Table I, Washington, D. C. "Feeding Cottonseed Products To Livestock".

SECTION A—COTTONSEED MEAL AS A CONCENTRATE

1—COTTONSEED MEAL VERSUS CORN

I

Cottonseed Meal Versus Shelled Corn for Finishing Beef Calves at State College, Mississippi, 1915-16.

The object of this test was to make a comparative study of cottonseed meal and of shelled corn as concentrates to be used in finishing calves which are fed silage as a principle roughage and a small amount of alfalfa hay.

The calves used in this test were from 7 to 8 months old, were a mixed lot of Shorthorn, Hereford and Angus, and were of unusually good quality, and would have sold as choice stockers.

The cottonseed meal used in this test was of good quality, analyzing from 7½ to 8 per cent ammonia, (38-41 per cent protein). The corn was of good quality, being matured and sound. The silage was of good quality having been cut at the proper stage and carrying considerable grain. The alfalfa was of rather low grade as it had been damaged by a heavy dew.

The lots were fed as follows:

Lot 1. Cottonseed meal, corn silage, alfalfa hay.

Lot 3. Shelled corn, corn silage, alfalfa hay.

Details of the experiment are shown in the following table.

**Table 2—Cottonseed Meal Versus Shelled Corn For Finishing Beef Calves
At State College, Mississippi.**

**November 12th, 1915 to April 16th, 1916.
(156 Days)**

Ration	Lot 1	Lot 3
	C. S. Meal Corn silage Alfalfa hay	Shelled Corn Corn silage Alfalfa hay
Av. initial wt., lbs.	430.	434.
Av. final wt., lbs.	701.	714.
Av. gain per steer, lbs.	271.	280.
Av. daily gain per steer, lbs.	1.74	1.8
Av. daily ration fed, lbs.:		
Cottonseed meal	3.69	
Shelled corn		8.78
Corn silage	22.87	13.80
Alfalfa hay	4.65	4.49
Feed required per 100 lb. gain, lbs.:		
Cottonseed meal	213.	
Shelled corn		489.
Corn silage	1318	769
Alfalfa hay	268	250

Note: The dressing percentage as reported by the slaughter pen indicated that the ration containing corn produced fatter carcasses than those containing cottonseed meal.

Reference: Mississippi Agricultural Experiment Station Bulletin 183, "Baby Beef and Calf Feeding," September 1917, State College, Miss.

Suggestive: What was the total gain made in Lot 1? In Lot 3? Under average farm conditions in your locality, which ration proved most economical if each of the roughages were produced on the farm and the concentrates bought at prevailing prices?

II

Cottonseed Meal Versus Ground Corn as a Fattening Feed for Beef Cattle at Manhattan, Kansas, 1924-25.

The object of this experiment was to test the feeding value of cottonseed meal and ground corn meal when fed under the same conditions.

Light weight yearling steers were used. One lot was fed cottonseed meal as the concentrated portion of the ration; the other 1 pound of cottonseed meal per head per day and enough ground corn to make the corn and 1 pound of cottonseed meal equal the amount of cottonseed meal in the other lot.

Method of feeding. The cattle in lot 1 receiving cottonseed meal as a basal ration were started on 5 pounds of cottonseed meal and those in lot 2 on 4 pounds of corn and 1 pound of cottonseed meal. The cottonseed meal was gradually increased until a maximum daily allowance of 15 pounds was fed during the last few days. Whenever the cottonseed meal allowance was increased in lot 1, the corn allowance was increased a like amount in lot 2. The same amounts of silage and alfalfa hay were fed each lot each day of the experiment.

Table 3—Cottonseed Meal Versus Ground Corn as a Fattening Feed for Beef Cattle at Manhattan, Kansas, Winter of 1924-25. 140 day test.

Lot No.	1	2
Basal Ration	C. S. Meal	Ground Corn
No. of days on feed.....	140	140
Initial weight, lbs.....	546	552
Final weight, lbs.....	880	892
Total gain, lbs.....	334	340
Average daily gain, lbs.....	2.39	2.43
Average daily ration: lbs.		
Corn		10.04
Cottonseed meal	11.04	1.00
Alfalfa hay	2.01	2.01
Silage	20.00	20.00
Feed required per 100 lbs. gain, lbs.:		
Corn		413.47
Cottonseed meal	462.81	41.18
Alfalfa hay	84.13	82.65
Silage	838.32	823.53

Note: The yearlings receiving cottonseed meal as a basal ration showed a bit more finish, better coats of hair, and more bloom than the yearlings receiving a basal ration of ground corn and outsold them by 25 cents per hundredweight. The cattle seemed to be normal in every respect at the end of the test.

Reference: Kansas Agricultural Experiment Station Circular 128, pages 8, 9 and 10, Table IV, "Cattle Feeding Investigations, 1924-25," October, 1926, Manhattan, Kansas.

Suggestive: What is the average daily gain in Lot 1? In Lot 2? Which lot required the greatest amount of concentrate per 100 pounds gain? Which concentrate would you feed under your conditions?

2—COTTONSEED MEAL VERSUS SOYBEANS

I

Soybeans Versus Cottonseed Meal as a Supplement to Corn for Fattening Two Year Old Cattle at Lafayette, Indiana, 1925-27.

Object—In order to determine the relative feeding value of whole soybeans and cottonseed meal for fattening two year old cattle, the Indiana Experiment Station conducted two trials, one in 1925-26, and another in 1926-27.

The cattle used in the 1925-26 trial were two year old steers which were a mixture of reds and roans with fairly good heads of medium quality and in fair flesh.

The cattle used in the 1926-27 trial were two year old steers which were purchased in Chicago. They were of medium to good quality grade Shorthorns in fair flesh. They were fed corn silage, and clover hay until the experiment started on November 17.

The feeds used in these trials were as follows:

The corn silage was locally grown and contained more moisture than is normally found in corn at such seasons of the year. None of the corn could be graded No. 3. However, it was reasonably free from damaged grain. The clover hay was a good quality, but some years it contained some Timothy. The corn silage was made from well matured corn.

The ration fed each lot was as follows:

Lot 1. Shelled corn, soybeans, corn silage, clover hay and salt.

Lot 2. Shelled corn, cottonseed meal, corn silage, clover hay and salt.

Results of the experiment are given in the following table.

Table 4—Cottonseed Meal Versus Soybeans for Fattening Two Year Cattle at Lafayette, Indiana, 1925-27. An Average of Two Experiments. Average Length of Experiment, 150 Days.

Ration	Lot 1	Lot 2
	Shelled Corn Soybeans Silage Clover Hay Salt	Shelled Corn Cottonseed Meal Silage Clover Hay Salt
No. of steers per lot.....	10	10
Av. initial wt. per steer, lbs.....	897.0	896.7
Av. final wt. per steer, lbs.....	1273.7	1239.5
Av. gain per steer, lbs.....	376.7	342.8
Av. daily gain, lbs.....	2.51	2.29
Av. total feed consumed, lbs.:		
Shelled corn	1851.75	1844.25
Supplement	342.65	342.95
Silage	3619.20	3930.30
Hay	524.25	553.75
Salt	6.75	7.65
Av. daily feed per head, lbs.:		
Shelled corn	12.35	12.30
Supplement	2.28	2.29
Silage	24.13	26.20
Hay	3.50	3.69
Av. feed required per 100 lb. gain, lbs.:		
Shelled corn	492	538
Supplement	91	100
Silage	961	1146
Hay	139	162

Note: The cattle fed soybeans attained a higher finish than those receiving cottonseed meal according to the judgment of the committee of commission men and packer buyers.

Reference: Indiana Agricultural Experiment Station Bulletin 330, pages 8, Table I, "Cattle Feeding," January, 1929, Lafayette, Indiana.

Suggestive: What is the difference in the ration fed Lot 1 and the ration fed Lot 2? How much more total gain did the cattle make in Lot 2 than those in Lot 1? To what can this difference in gain be attributed? How much difference is there between the feed consumed in the two lots? Using the present feed prices, determine which ration gave the most economical gain?

II

Cottonseed Meal Versus Whole Soybeans as a Supplement to Corn for Fattening Calves at Lafayette, Indiana. 1925-28.

Object—In order to determine the relative feeding value of cottonseed meal and whole soybeans as a protein feed for calves, a series of trials were conducted at the Purdue University Experiment Station during the years 1925-26, 1926-27, 1927-28.

The calves used during the 1925-26 trial were raised in White County, Indiana. They were the product of grade Hereford range cows that had been brought from

the range in the fall before the calves were dropped in the spring. The sires were evidently pure-bred Hereford bulls. The calves ran with their dams on grass until November 12, 1925, when they were trucked to the experimental lot and started on the test.

The calves used in the 1926-27 trial were bred in the Sand Hill section of Nebraska. They were high-grade Hereford of choice quality in medium feeder condition with good size bones.

The calves used in the 1927-28 trial were purchased at a near-by town from a feeder who had shipped them in from Sterling, Colorado. They were of good to choice quality grade Herefords, rather small and in fair degree of flesh. On October 20, 1927, they were brought to a pasture near Lafayette where they grazed and learned to eat oats. On November 7, they were placed in the feed lots and fed oats, clover hay and corn silage until the experiment started November 16.

The feeds used in these trials were described as follows:

The corn silage was locally grown and contained more moisture than is normally found in corn at such seasons of the year. None of the corn could be graded No. 3. However, it was reasonably free from damaged grain. The clover hay was a good quality, but some years it contained some Timothy. The corn silage was made from well matured corn.

The lots were fed the following rations:

Lot 1. Shelled corn, cottonseed meal, corn silage and clover hay.

Lot 2. Shelled corn, whole soybeans, corn silage and clover hay.

Each lot was fed salt as a mineral supplement.

Table 5—Cottonseed Meal Versus Whole Soybeans as a Supplement to Rations for Fattening Calves at Purdue University. 1925-26, 1926-27, 1927-28. An Average of 3 Trials. Average Length of Each Trial, 237 Days.

Ration	Lot 1	Lot 2
	Shelled Corn C. S. Meal Corn Silage Clover Hay Salt	Shelled Corn Soybeans Corn Silage Clover Hay Salt
No. of animals in lot	15	14
Av. initial wt. per calf, lbs.	399.1	400.8
Av. final wt. per calf, lbs.	898.7	895.2
Av. gain per calf, lbs.	499.6	494.4
Av. daily gain, lbs.	2.10	2.08
Av. total feed consumed, lbs.:		
Shelled corn	3076	2821
Supplement	443	408
Corn silage	3963	3390
Clover hay	1166	1044
Salt	11	13
Av. daily feed, lbs.		
Shelled corn	8.55	8.55
Supplement	1.23	1.24
Corn silage	10.93	9.82
Clover hay	3.16	3.19
Av. feed per 100 lb. gain, lbs.		
Shelled corn	408	412
Supplement	59	59
Corn silage	523	500
Clover hay	152	153

Note: The finish of the cattle measured by the actual selling value and appraisal at the market, was not influenced by the supplement used in the ration. In each of the three years, both lots of cattle were appraised and sold at the same price. In no year, was any difference in degree of finish noticeable.

Reference: Indiana Agricultural Experiment Station Bulletin 330, pages 4, 5, 6 and 10, Table II, "Cattle Feeding," January, 1929, Lafayette, Indiana.

Suggestive: Which ration gave the larger gain per calf? How much more feed did Lot 1 consume than Lot 2 per 100 pound gain? If cottonseed meal and soybeans were the same price per ton which ration would be more economical? Calculated with the current feed prices, which ration is more economical per 100 pound gain?

III

Ground Soybeans Versus Cottonseed Meal as a Supplement to Corn for Fattening Beef Cattle at Lafayette, Indiana, 1919.

The actual feeding value of ground soybeans as a substitute for cottonseed meal in rations for fattening cattle has been tested at this station in a series of three trials with two and three-year-old cattle fed shelled corn, corn silage, and cured roughage. Two similar lots of cattle were fed the same ration, except that one lot received cottonseed meal and the other lot ground soybeans as supplements to the ration. Supplement was fed at the rate of 2.5 pounds daily per 1,000 pounds weight.

Table 6—Ground Soybeans Versus Cottonseed Meal for Fattening Beef Cattle at Lafayette, Indiana—Summary of three trials.

	Lot 1 Ground Soybeans Lbs.	Lot 2 Cottonseed Meal Lbs.
Animals per lot.....	10	10
Average initial weight.....	992.4	994.2
Average final weight.....	1382.4	1399.1
Average total gain.....	390.0	404.9
Average daily gain.....	2.32	2.41
Average daily feed consumed:		
Shelled corn.....	13.37	13.80
Cottonseed meal.....		2.95
Ground soybeans.....	2.92	
Cured roughage.....	1.07	2.08
Corn silage.....	23.65	25.86
Average required per 100 lbs. gain:		
Shelled corn.....	576.25	57.56
Cottonseed meal.....		121.39
Ground soybeans.....	125.85	
Cured roughage.....	46.12	86.30
Corn silage.....	1019.31	1072.93

The ground soybeans had a marked laxative effect. The cattle were too loose at all times. During the second trial, the laxative effect of the soybeans increased as the feeding period advanced, but in the other two trials the effect was rather uniform during the time the cattle were on feed. The laxative effect was less pronounced in the third trial than in either of the others. This effect of the soybeans was doubtless due to the large percentage of fat contained therein.

The palatability of the ground soybeans was somewhat variable. During the third trial, the cattle ate the beans with relish throughout the entire feeding period. In the other two trials, the cattle ceased after about three months on feed to have the keen, eager appetites desirable in fattening stock. After the cattle had once lost their appetites and came back on feed, extreme care was necessary to prevent them from again going "off feed". This was especially marked during the last half of the second trial when the cattle had a decided aversion to soybeans and were very sensitive to every factor affecting their appetites. Although the steers in one trial maintained their appetites throughout the feeding period, it is perfectly obvious that soybeans are not usually palatable to fattening cattle after they have been fed for ninety to one hundred days.

Reference: Purdue University Agricultural Experiment Station Bulletin No. 237, Pages 4, 5, Table 2, "Ground Soybeans for Fattening Cattle," March, 1920, Lafayette, Indiana.

Suggestive: What was the average total gain in Lot 1? In Lot 2? What was the difference in cost per 100 lbs. gain in the two lots? Which meal would be more practical to feed?

IV

Feeding Cottonseed Meal to Fattening Steers in a Winter Ration at Lafayette, Indiana, 1922-23.

The object of the trials were to determine the relative value of cottonseed meal, soybean oilmeal, whole soybeans, and whole soybeans and a mineral mixture in rations of shelled corn, clover hay and corn silage, and to determine the value of cottonseed meal in the ration.

The steers were divided into lots equal in size, condition, quality and thriftiness. Each lot of steers occupied similar quarters, which consisted of an uncovered, concreted lot 20x28 feet and an open shed 16x28 feet on the west. The sheds were kept well bedded. The winter was open with little snow. The lots were kept reasonably clean at all times.

The cattle were fed under cover. Water was supplied in galvanized iron troughs adjacent to the open lots, care being taken to keep the water fresh in these troughs. No method of heating was used, but the ice accumulating in the troughs was removed twice a day. The cattle had water before them at all times.

The method of feeding was the same in all lots. Silage was distributed in the troughs: corn, when fed, was poured over the silage, and cottonseed meal sprinkled over the other feed in the troughs. Hay was fed twice daily in racks. Feeding was begun at 6 A. M. and 4:30 P. M. and completed in about an hour and a half.

The amount of hay and silage was governed by the appetites of the cattle. Supplement in lots where used was fed at the rate of 2.5 pounds daily per 1000 pounds live weight. Corn in Lots 1, 2, 3, 4 and 7 was fed according to appetite after the cattle had been brought to a full feed. The cattle in Lots 5 and 6 received no corn for 90 days, after which time they were brought to a full feed in about thirty days. Salt was kept before all lots except Lot 3, which had before it a mineral mixture consisting of equal parts of salt, acid phosphate and pulverized limestone.

The cattle were purchased on the Chicago market November 14, 1922, before the trial started November 22, 1922. They were of medium quality and rather thin in flesh. The cattle in Lots 5 and 6 were thinner than those in the other lots. Five steers in each of Lots, 1, 2, 3, 4 and 7 showed a preponderance of Hereford blood. The others were grade Shorthorns.

Corn used in these trials was sound and of good quality. The cottonseed meal was of choice grade containing 41 per cent crude protein. The soybean oilmeal was choice and contained 40 per cent crude protein. The soybeans were grown locally and were plump and sound. The hay was pure clover but of medium quality. The silage was well kept and made from corn yielding about 35 bushels per acre, cut when ripe enough to shock and watered.

The cattle received all the corn silage and clover hay they would eat when the trial began. Lots 1, 2, 3, 4 and 5 were started on six pounds of supplement the first day of the trial and gradually raised to 2½ pounds daily per 1000 pounds live weight at the end of twenty days. In Lots 1, 2, 3, 4 and 7 corn was fed at the rate of four pounds daily per head the first day and gradually increased to a full feed within a month. No corn was fed in Lots 5 and 6 for ninety days. It was then fed at the rate of five pounds daily per head and gradually increased to a full feed at the end of a month.

Table 7—Cottonseed Meal Versus Soybean Oilmeal Versus Whole Soybeans Versus Whole Soybeans with Mineral Mixture for Feeding Beef Cattle at Lafayette, Indiana, 1922-23. (An 8 Month Test).

Ration	Lot 1	Lot 2	Lot 3	*Lot 4
	Shelled Corn, Soybean Oilmeal, Silage, Clover hay, Salt	Shelled Corn, Soybeans, Silage, Clover hay, Salt	Shelled Corn, Soybeans, Silage, Clover hay, Mineral Mixture	Shelled Corn, Cottonseed Meal, Silage, Clover hay, Salt
No. of steers per lot.....	10	10	10	9
Average initial weight, lbs.....	945.8	945.0	948.5	946.2
Average final weight, lbs.....	1271.5	1282.0	1268.3	1269.7
Average gain per steer, lbs.....	325.7	337.0	319.8	323.4
Average daily gain, lbs.....	2.17	2.25	2.13	2.16
Total feed consumed, lbs. Av. per steer :				
Shelled corn	1878.5	1884.0	1884.0	1875.9
Supplement	387.4	388.15	388.15	389.5
Corn silage	4429.6	4486.2	4476.5	4561.8
Clover hay	373.0	448.0	500.5	526.7
Daily feed per steer, lbs. :				
Shelled corn	12.52	12.56	12.56	12.51
Supplement	2.58	2.59	2.59	2.60
Corn silage	29.53	29.91	29.84	30.41
Clover hay	2.49	2.99	3.34	3.51
Feed per 100 lb. gain, lbs. :				
Shelled corn	577.0	559.0	589.0	580.0
Supplement	119.0	115.0	121.0	124.0
Corn silage	1360.0	1331.0	1400.0	1410.0
Clover hay	115.0	133.0	157.0	163.0

*9 Steers in Lot 4.

Note: the cattle in Lot 4 during two weeks of the second month did not eat well. They consumed somewhat less corn during this period than the other three lots. Cattle in all the four lots were somewhat slow in consuming their feed during the latter part of the third month. Other than this the cattle ate well at all times. It will be noted in the table that there was a marked uniformity

of appetite in all lots except in Lot 4 during the second and fourth months, in one case this lot being below the other three lots of cattle. On the whole it can be said that the supplement fed the cattle had no marked influence on their appetites. The cattle in all lots made highly satisfactory gains during the first two months but during the last three months failed to make gains that are to be expected from cattle under such conditions.

Table 8—The Feeding Value of Cottonseed Meal When Added to a Ration Containing Silage For Fattening Steers, Lafayette, Indiana, 1922-23. (8 Months Test).

Rations	*Lot 4	Lot 7	*Lot 5 Silage, Cottonseed Meal, Clover hay 90 days. Full feed shelled corn added, 150 days, salt	Lot 6 Silage, Clover hay 90 days, full feed shelled corn added 150 days, salt
	Shelled Corn, Cottonseed Meal, Silage, Clover hay, Salt	Shelled Corn, Silage, Clover hay, Salt		
No. of steers per lot.....	9	10	9	10
Average initial weight, lbs.....	946.22	947.7	765.0	766.3
Average final weight, lbs.....	1269.67	1235.0	1263.3	1213.0
Average gain per steer, lbs.....	323.4	287.3	501.2	446.7
Average daily gain, lbs.....	2.16	1.92	2.09	1.86
Total feed consumed per steer, av., lbs.:				
Shelled corn	1875.9	1884.0	1885.33	1891.0
Cottonseed meal	389.4	-----	571.4	-----
Corn silage	4561.7	4683.0	7268.8	7507.3
Clover hay	526.7	405.5	776.1	1028.0
Daily feed per steer, lbs.:				
Shelled corn	12.51	12.56	7.86	7.88
Cottonseed meal	2.60	-----	2.38	-----
Corn silage	30.41	31.22	30.29	31.28
Clover hay	3.51	2.70	3.23	4.28
Feed per 100 lb. gain, lbs.:				
Shelled corn	580.0	656.0	376.0	423.0
Cottonseed meal	124.0	-----	114.0	-----
Corn silage	1410.0	1630.0	1450.0	1681.0
Clover hay	163.0	141.0	155.0	231.0

* 9 steers in Lots 4 and 5.

Reference: Indiana Agricultural Experiment Station Bulletin 281, pages 4, 5, 6, 7, 8, 9, 10, and 14, Tables IV and VIII, "Cattle Feeding—Winter Steer Feeding," June, 1924, Lafayette, Indiana.

Suggestive: Do the results of this test indicate that soybeans have a higher feeding value than cottonseed meal? Which would be more economical to feed in your locality, soybeans or cottonseed meal? In each case where cottonseed meal was fed in the ration with silage, did the increase in gain justify the cost of the meal? (Use current prices). Which of the rations would be considered "balanced"?

3—COTTONSEED MEAL VERSUS OATS

I

Cottonseed Meal Versus Whole Oats Versus Ground Oats in Rations for Fattening Two Year Old Cattle at Purdue University, Lafayette, Indiana, 1926-1928.

The purpose of this experiment was to determine the value of cottonseed meal, ground oats and whole oats for fattening two year old cattle. In order to make such determinations, the Indiana Experiment Station conducted two trials, one in 1926-1927, the other in 1927-1928.

The cattle used in the 1926-27 test were bought in Chicago. They were of medium to good quality grade Shorthorns in fair flesh. They were fed corn silage and clover hay until the experiment started November 17.

The cattle used in the 1927-28 trial were two year olds purchased in Chicago. They were grade Shorthorns of medium to good quality in good feeder flesh. They were fed oat straw and corn silage from their arrival at Purdue farm until started on their experiment November 16.

In both trials the cattle were quartered in Purdue experimental lots in open sheds similar in size and equipment and were treated the same in every way with the exception of the rations fed.

The feeds used in this experiment were described as follows:

The corn was locally grown and contained more moisture than was normally found in corn at such seasons of the year. None of the corn would have graded No. 3. However, it was reasonably free from damaged grain. The cottonseed meal was choice grade containing 41 per cent protein. The clover hay was a good quality and contained some Timothy. The corn silage was made from well matured corn.

The ration fed each lot was as follows:

Lot 1. Shelled corn, cottonseed meal, corn silage, clover hay and salt.

Lot 2. Shelled corn, whole oats, corn silage, clover hay and salt.

Lot 3. Shelled corn, ground oats, corn silage, clover hay and salt.

Results of the experiment are given in the following table.

Table 9—Cottonseed Meal Versus Whole Oats Versus Ground Oats in Rations For Fattening Two Year Old Cattle at Purdue University. 1926-28. Average of Two Experiments. Average Length of Each Experiment, 150 Days.

Ration	Lot 1 C. S. Meal	Lot 2 Whole oats	Lot 3 Ground oats
No. of steers per lot.....	10	10	10
Av. initial wt. per steer, lbs.....	928.5	925.8	924.8
Av. final wt. per steer, lbs.....	1296.0	1250.0	1274.9
Av. gain per steer, lbs.....	367.9	324.2	350.1
Av. daily gain lbs.....	2.45	2.16	2.33
Av. total feed consumed, lbs.			
Shelled corn	1821.35	1471.20	1471.20
Oats		729.85	729.85
Cottonseed meal	341.35		
Silage	4441.50	3711.75	4051.5
Clover hay	425.50	407.50	358.00
Salt	7.15	8.00	5.75
Av. daily feed per head, lbs.			
Shelled corn	12.14	9.81	9.81
Oats		4.87	4.87
Cottonseed meal	2.28		
Silage	29.61	24.75	27.01
Hay	2.84	1.36	1.19
Av. feed required per 100 lb. gain, lbs.:			
Shelled corn	495.	454.	420.
Oats		225.	209.
Cottonseed meal	93.		
Silage	1207.	1145.	1157.
Hay	116.	126.	102.

Note: The cattle fed cottonseed meal attained a distinctly better finish according to valuations of the cattle by a committee of commissioners and packer buyers.

Reference: Indiana Agricultural Experiment Station Bulletin 330, pages 4, 5, and 20, Table V, "Cattle Feeding," January, 1929, Lafayette, Indiana.

Suggestive: How does the average gain per steer compare in each lot? Does grinding of oats increase their feeding value enough to make them equal in feeding value to cottonseed meal? Under average farm conditions in your locality, which of the three rations would give the most profit per steer? Which of the rations would more nearly be classed as "balanced?"

4—COTTONSEED MEAL VERSUS VELVET BEANS

I

Velvet Bean-and-Pod Meal, Cottonseed Meal, and Varying Proportions of Corn and Velvet Bean-and-Pod Meal Compared for Fattening Steers at State College, Mississippi, 1917-18.

For the purpose of studying the relative economy of velvet bean-and-pod meal, velvet bean-and-pod meal and corn, and cottonseed meal, when fed with silage to beef steers, the Mississippi Experiment Station in the winter of 1917-18 fed five lots of beef cattle for one hundred and forty days. Corn silage was fed ad libitum to all lots throughout the trial. Cottonseed meal, velvet bean-and-pod meal, and broken ear corn were fed in accordance with the following plan:

Table 10—Concentrates Fed Daily Per Thousand Pounds of Cattle.

Lot	I	II	III	IV	V
First 56 Days					
Cottonseed Meal (lbs.).....	5	-----	-----	-----	-----
Velvet Bean-and-Pod Meal (lbs.).....	-----	10.	8.	6.	4.
Broken Ear Corn (lbs.).....	-----	-----	6.25	12.5	18.75
Second 56 Days					
Cottonseed Meal (lbs.).....	6.	-----	-----	-----	-----
Velvet Bean-and-Pod Meal (lbs.).....	-----	12.	10.	8.	6.
Broken Ear Corn (lbs.).....	-----	-----	6.25	12.5	18.75
Last 28 Days					
Cottonseed Meal (lbs.).....	7.	-----	-----	-----	-----
Velvet Bean-and-Pod Meal (lbs.).....	-----	14.	12.	10.	8.
Broken Ear Corn (lbs.).....	-----	-----	6.25	12.5	18.75
Average for Entire Period (140 da.)					
Cottonseed Meal (lbs.).....	5.8	-----	-----	-----	-----
Velvet Bean-and-Pod Meal (lbs.).....	-----	11.6	9.6	7.6	5.6
Broken Ear Corn (lbs.).....	-----	-----	6.25	12.5	18.75

The cattle used in this trial were good to choice grade beef steers bought locally in the fall of 1916. They were grazed through the summer of 1917 and from frost until being put in the feed lots had the run of stalk, pea and velvet bean fields. The breeding of the cattle used in these experiments were Shorthorn, Red Poll, Angus, and Hereford Grades.

Table 11—Cottonseed Meal Versus Velvet Bean-and-Pod Meal Versus Varying Proportions of Broken Ear Corn and Velvet Bean-and-Pod Meal for Fattening Steers at State College, Mississippi, 1917-18. 140 Days.

Lot	1 Cottonseed meal, Silage	2 Velvet Bean-and- pod Meal Silage	3 Velvet Bean-and- Pod Meal, Light corn ration Silage	4 Velvet Bean-and- Pod Meal, Medium Corn ration Silage	5 Velvet Bean-and- Pod Meal, Heavy corn ration, Silage
No. of animals	8.	8.	8.	8.	8.
Initial weight, total (lbs.).....	8540.33	8058.	8015.66	7969.66	8125.33
Av. initial weight (lbs.).....	1067.54	1007.25	1001.96	996.21	1015.66
Av. final weight (lbs.).....	1333.04	1229.46	1228.58	1297.08	1308.04
Av. gain per steer (lbs.).....	265.5	222.21	226.62	300.87	292.38
Av. daily gain per steer (lbs.)	1.9	1.59	1.62	2.15	2.09
Feed consumed per steer					
Cottonseed meal (lbs.).....	812.	.....	.....	.....	.....
Velvet Bean-and-Pod					
Meal (lbs.) .....	.....	1624.	1342.75	1064.	784.
Broken Ear Corn (lbs.).....	.....	.....	875.	1750.	2625.
Silage (lbs.)	10943.75	10083.75	7436.25	5360.	4153.75
Average daily feed per steer					
Cottonseed meal (lbs.).....	5.8	.....	.....	.....	.....
Velvet Bean-and-Pod					
Meal (lbs.) .....	.....	11.6	9.59	7.6	5.6
Broken Ear Corn (lbs.).....	.....	.....	6.25	12.5	18.75
Silage (lbs.)	78.17	72.03	53.12	38.29	29.67
Feed Required per cwt. of gn.					
Cottonseed meal (lbs.).....	305.84	.....	.....	.....	.....
Velvet Bean-and-Pod					
Meal (lbs.) .....	.....	730.85	592.50	353.64	268.15
Broken Ear Corn (lbs.).....	.....	.....	386.1	581.64	897.82
Silage (lbs.)	4121.94	4537.99	3281.3	1781.47	1420.69

Reference: Mississippi Agricultural Experiment Station Bulletin 222, pages 6, 7 and 8, Table II, "Steer Feeding Experiments," May 1924, State College, Mississippi.

II

Cottonseed Meal Compared with Dry Velvet Beans and Soaked Velvet Beans When Fed With Corn Silage for Fattening Beef Steers at McNeill, Mississippi, 1920.

Object—In 1920 an experiment on fattening steers was conducted at McNeill, Mississippi, to determine the relative value of cottonseed meal and velvet beans when fed with silage. In the experiment 30 high-grade three or four year old feeder steers of Hereford, Angus, and Shorthorn types, were divided into three groups of ten each as nearly uniform as possible.

The silage was made from fully-matured corn and as a whole was bright and of good quality. The velvet beans fed Lot 3 were soaked for 12 hours before feeding. In a preliminary feeding period of two weeks, a limited amount of cottonseed meal and corn silage was fed. During the first period the quantity of silage had to be reduced temporarily because all of the steers were slightly off their feed and were scouring badly.

Table 12—Cottonseed Meal Compared With Dry Velvet Beans and Soaked Velvet Beans for Fattening Beef Cattle at McNeill, Mississippi, 84 Day Test, 1920.

Rations	Lot 1 C. S. Meal and corn silage	Lot 2 Dry velvet beans and corn silage	Lot 3 Soaked velvet beans and corn silage
Number of steers	10	10	10
Average initial weight per steer	810	786	802
Average final weight per steer	988	1021	990
Average total gain per steer	178	235	88
Average daily gain per steer	2.1	2.8	1.04
Average daily feed consumption per steer			
Cottonseed meal	5.1	.....	.....
Corn silage	50.6	39.8	41.5
Dry Velvet Beans .....	.....	11.9	.....
Soaked velvet beans .....	.....	.....	11.9
Feed required per 100 lb. gain			
Cottonseed meal	242.8	.....	.....
Corn silage	2409	1421.2	1886.1
Dry velvet beans .....	.....	424.9	.....
Soaked velvet beans .....	.....	.....	540.8

Reference: Department of Agricultural Education, Clemson College, S. C. "Agricultural Education" Vol. 12, No. 1, Page 7, 9.

Suggestive: What was the average total gain in Lot 1? In Lot 2? In Lot 3? Which produced the more economical gains, cottonseed meal or dry velvet beans? Did soaking the beans pay?

III

Velvet Beans in the Pods Versus Cottonseed Meal as a Concentrate Part of a Ration for Fattening Steers at Auburn, Alabama, 1916-17.

Object—This experiment was planned with a view of determining the relative feeding values of velvet beans in the pod and cottonseed meal as a concentrate part in the ration of fattening steers.

The steers used in this experiment were grades showing either Angus, Hereford or Shorthorn blood. They were divided into 2 lots of 15 each and were given the following feeds:

Lot 1. Velvet beans in pods, corn silage.

Lot 2. Cottonseed meal, corn silage.

The steers were fed under average farm conditions with the feed lots located in a cedar grove. The cedar grove gave all the protection the steers had during the experiment. The lots had a southern exposure and were well drained. The manure was hauled out of the lots every few days. No bedding was used, but the lots were dry enough so that the steers could lie down comfortably. Pure water from a deep well was kept before the steers at all times. Block salt was kept in the feed troughs continuously.

The steers were fed twice each day. The concentrates and roughages were mixed thoroughly by hand in the feed troughs. The amount of feed was regulated so that it was consumed in a few hours.

As the pastures began to fail in the fall the steers had the run of the stalk fields. They were in the stalk fields during the month of November. Eighteen days previous to going on the experiment the steers were fed, while in the stalk fields, two pounds of velvet beans and twelve pounds of corn silage per head per day. The preliminary feeding was done to accustom them to feeding and handling and to secure a uniform fill.

The beans were fed in the pod and were thoroughly mixed with the silage in the trough so that each steer would get only his share of the beans. After the experiment continued four weeks the beans were soaked in the pod and seemed to assist the steers in masticating the beans.

Details of the experiment are given in the following table.

Table 13—Velvet Beans in the Pod Versus Cottonseed Meal as a Concentrate Feed For Fattening Steers at Auburn, Alabama. December 21, 1916 to April 19, 1917. (119 Days).

Ration	Lot 1	Lot 2
	Velvet Beans and Corn Silage	C. S. Meal and Corn Silage
No. of steers per lot.....	15	15
Av. initial wt. lbs.	773.4	777.7
Av. final wt., lbs.	963.7	963.2
Av. gain per steer, lbs.....	190.3	185.5
Av. daily gain per steer, lbs.....	1.6	1.55
Av. daily ration consumed, lbs.		
Velvet beans	10.6	.....
Corn silage	28.5	42.6
Cottonseed meal .....	.....	5.
Feed required per 100 lb. gain, lbs.		
Velvet beans	670.	.....
Corn silage	1733.	2811.
Cottonseed meal .....	.....	327.

Note: Both rations were relished by the steers and at no time during the test was there any trouble due to the steers going off feed.

Reference: Alabama Agricultural Experiment Station Bulletin 198, Part I, "Beef Cattle Feeding Experiments," November, 1917, Auburn, Alabama.

Suggestive: Which lot required the greater amount of corn silage per 100 lb. gain? Under your conditions could you afford to feed 2 pounds of velvet beans in the pod to replace 1 pound of cottonseed meal?

5—COTTONSEED MEAL AS A SUPPLEMENT TO HAY AND PASTURE

I

Cottonseed Meal as a Supplement to Pasture for Fattening Steers in the Black Belt of Alabama. 1927-32.

In the spring of 1927, through a cooperative arrangement, an experiment was started on Kirkwood plantation, Faunsdale, Alabama, with the object of determining the affects of feeding cottonseed meal to steers that were being finished on pasture for the July market. After the experiment had been conducted for about three years the plan was expanded and another group of steers

was added. The added objective was to compare two systems of management; namely, the feeding of cottonseed meal to steers on pasture and selling the steers in July versus the fattening of steers on pasture alone and selling them in September.

All steers used in these experiments were two-year-old, high grade Herefords. They were raised on the farm where the experiments were conducted or on adjoining farms in the community. These steers were strong and thrifty at the beginning of the experiments. They were weighed individually on three consecutive days at the beginning and at the close of the experiment. The average of the three weights was taken as the initial and the final weights, respectively.

Each group of steers was turned into a large Black Belt pasture where there was an abundance of grazing at all times. The pastures were composed mostly of black medic, Dallis grass, white clover, and Bermuda grass. Steers in Lot 1 received in addition to the pasture an average allowance of 4.69 pounds of 37 per cent protein cottonseed meal per head daily. Steers in Lot 2 (check lot) were on pasture with no supplement. Both lots were sold in July. Steers in Lot 3 (during the last three years of the experiment) were on pasture with no supplement and were sold in September.

The steers which received cottonseed meal made fairly uniform gains during each of the six years, while the gains made by the steers on pasture alone were much less uniform. This condition was probably due to the fact that the steers in Lot 2 were dependent entirely on pasture for feed and they were affected more by the variation in seasons than those in Lot 1.

Table 14—The Effect of Cottonseed Meal on Gains of Steers When on Pasture at Auburn, Alabama, 1927-32. (A Six Year Average)*

Ration	Lot 1 Pasture and C. S. Meal	Lot 2 Pasture Only
No. of steers	17.5	16
Days on pasture	84	84
Av. initial weight, lbs.	600	600
Av. final weight, lbs.	805	757
Total gain per steer, lbs.	205	157
Daily gain per steer, lbs.	2.47	1.92

*Average obtained by adding six years' results and dividing by six (6).

Note: The average daily meal allowance per steer was 4.69 pounds.

Although the steers on pasture alone made very cheap gains they were not finished sufficiently in 70 to 90 days to meet the demands of the butcher. The question naturally arose as to which would be better practice, to feed steers cottonseed meal on pasture and market them in July (apparently there would be very little virtue in feeding meal and selling the steers in September because the main object in feeding meal is to increase the rate of gain and get the cattle ready for the early market when grass-fat cattle are not plentiful) or to fatten them on pasture alone and sell them in September.

In order to compare these two systems of management, a third group of steers, Lot 3, was added to the experiment in the spring of 1930. This group was managed similarly to that of Lot 2 with the exception that they were continued on pasture until September.

Table 15—Pasture Supplemented with Cottonseed Meal Versus Pasture Alone for Finishing Steers for the July Market at Auburn, Alabama, 1930-32.
(A Three Year Average)†

Ration	*Lot 1 Pasture and C. S. Meal	*Lot 2 Pasture Only	Lot 3** Pasture Only
No. of steers	23.67	20.67	18.33
Days on pasture	90.33	90.33	154
Av. initial weight, lbs.	627	629	627
Av. final weight, lbs.	844	796	885
Av. total gain per steer, lbs.	217	167	258
Av. daily gain per steer, lbs.	2.42	1.89	1.67

†Average obtained by adding three years' results and dividing by three (3).

*Steers sold in July. **Steers sold in September.

Reference: Alabama Agricultural Experiment Station Circular 72, pages 4, 5, 7 and 8, Tables I and V, "Cottonseed Meal as a Supplement to Pasture for Fattening Steers in the Black Belt of Alabama," March, 1935, Auburn, Alabama.

Suggestive: What effect did the feeding of cottonseed meal have on the rate of gain? With cottonseed meal and beef figured at current prices, was the feeding of cottonseed meal to cattle on pasture justified?

II

Cottonseed Meal and Johnson Grass Hay Versus Johnson Grass Hay Alone for Wintering Steers in Johnson Grass Hay Fields.

Seventeen steers were wintered in Johnson grass hay fields where they had access to hay stacked in the field during the winter of 1931. No cottonseed meal or other supplements were fed and no shelter was provided. These steers made an average gain of 78 pounds in 140 days.

In 1932, twenty steers were fed and managed as described above and they made an average gain of 10 pounds in 125 days. The average gain per steer for the two-year period was 41 pounds. It was not practicable to keep a record of the hay eaten by these steers because the hay was self-fed from the stacks.

Table 16—Cottonseed Meal and Johnson Grass Hay Versus Johnson Grass Hay Alone For Wintering Steers in Johnson Grass Hay Fields.
Auburn, Alabama, 1931-32. (125 Days)

Ration	Lot 1	Lot 2
	Johnson Grass Hay Fields with free access to stacked hay	Johnson Grass Hay Fields with free access to stacked hay and 1 lb. cottonseed meal per head daily
Year	1932	1932
No. of steers wintered	20	20
Av. wintering period (days)	125	125
Av. initial wt. per steer, lbs.	548.00	549.20
Av. final wt. per steer, lbs.	558.00	649.75
Av. gain per steer, lbs.	10.00	100.55
Av. daily gain per steer, lbs.	.08	.80
Av. daily feed per steer, lbs.		
Johnson grass hay	15.00	15.00
Cottonseed meal		1.00
Feed required per 100 lb. gain, lbs.		
Johnson grass hay	18750	1865
Cottonseed meal		124

Reference: Alabama Experiment Station Circular 71, pages 2, 3, 4, 5, 6 and 7, Tables I, II and III, "Wintering Steers in the Black Belt of Alabama", February, 1935, Auburn, Alabama.

Suggestive: What effect did cottonseed meal have on the average daily gain by the steers? On an average, would you expect steers to gain or lose weight on ration of Johnson grass hay during the winter? Would you feed one or two pounds of cottonseed meal per day with Johnson grass hay for wintering steers?

III

The Value of Cottonseed Meal When Fed with Native Hay for Wintering Range Calves at Laramie, Wyoming, 1922-23.

The object of this test was to ascertain the value of cottonseed meal when fed with native hay for wintering range calves.

Cattle used—Twenty head of average range calves, with Hereford breeding predominating, were loaned to the Station for this test. They had just been weaned, were quite uniform in type and size, and would grade as fair feeder calves. When placed on experiment they averaged 444.99 pounds.

The calves were divided into two groups of ten each, so that each group was representative of the whole, and placed in lots 25x125 feet. Each lot had access to a shed, open on the south side which after being thoroughly cleaned was covered with dry sand at the beginning of the trial.

The hay was fed in large racks, the silage and cottonseed meal in bunks. The calves quickly became accustomed to the cottonseed meal, cleaning it up shortly after being fed. Salt was provided in the form of blocks under each shed.

The hay was grown northwest of Laramie and baled from the stack before delivery. It was only fair in quality, consisting mainly of wheat grasses and Baltic rush.

Table 17—Native Hay Versus Native Hay and Cottonseed Meal When Fed to Wintering Range Calves at Laramie, Wyoming. 168 Days, November 22, 1922 to May 9, 1923.

	Lot 1 Native Hay	Lot 2 Native Hay cottonseed meal
Number of calves per lot	10	10
Average initial weight (lbs.)	448.16	441.33
Average final weight (lbs.)	508.0	570.83
Average gain per calf (lbs.)	59.84	129.5
Average daily gain per calf (lbs.)	.35	.77
Daily ration consumed (lbs.):		
Native hay	10.	5.
Cottonseed meal .....	.....	1.125
Feed consumed per 100 lbs. gain (lbs.):		
Hay	2877.6	648.6
Cottonseed meal .....	.....	145.9

Reference: Wyoming Agricultural Experiment Station, Bulletin 134, Pages 3, 10, 11, 12, Table 5, "Wintering Range Calves," May, 1923, Laramie, Wyoming.

Suggestive: What was the total gain per calf in each lot? Were the additional gains made in lot 2 sufficient to pay for the cottonseed meal? (Calculate on basis of current prices.)

IV

Johnson Grass Hay and One Pound of Cottonseed Meal Versus Johnson Grass Hay and Two Pounds of Cottonseed Meal at Auburn, Alabama. 1929-31.

During the winters of 1929, 1930, and 1931 the efficiency of one pound of cottonseed meal per head daily was compared with the efficiency of two pounds of cottonseed meal per head daily as supplements to Johnson grass hay for wintering steers. The hay was self-fed from racks in a barn, although both groups of steers had access to permanent pasture plots of approximately 10 acres. There were 34 steers in each group during the first year, 15 in each group during the second year, and 17 in each group during the third year; the length of the different wintering periods was 119 days, 133 days, and 140 days, respectively.

Table 18 One Pound Versus Two Pounds of Cottonseed Meal per Head Daily as a Supplement to Johnson Grass Hay for Wintering Steers at Auburn, Alabama, 1929-31. (131 Days Average Each Year).

Ration	Lot III				Lot IV			
	Johnson grass hay self-fed from racks, and 1 lb. cottonseed meal per head daily.				Johnson grass hay self-fed from racks, and 2 lbs. cottonseed meal per head daily.			
Year	1929	1930	1931	3 yr. av.	1929	1930	1931	3 yr. av.
No. of steers wintered	34	15	17	22	34	15	17	22
Av. wintering period (days) ..	119	133	140	127.6	119	133	140	127.60
Av. init'l wt. per steer (lbs.) ..	502.0	636.0	553.0	545.0	495.0	642.0	554.0	543.0
Av. final wt. per steer (lbs.) ..	533.0	651.0	663.0	593.0	508.0	663.0	675.0	586.0
Av. gain per steer (lbs.)	31.0	15.0	110.0	48.0	13.0	21.0	121.0	42.0
Av. daily gain per steer (lbs) ..	.....	.....	.....	.36	.....	.....	.....	.32
Av. daily feed per steer (lbs.) ..	.....	.....	.....	.....	.....	.....	.....	.....
Cottonseed meal	1.00	1.00	1.00	1.00	2.00	2.00	2.00	2.00
Johnson grass hay	13.60	14.27	10.84	12.98	12.67	14.02	12.43	12.92
Feed consumed per 100 lb. gain, (lbs.)	.....	.....	.....	.....	.....	.....	.....	.....
Cottonseed meal .....	.....	.....	.....	277.77	.....	.....	.....	625.0
Johnson grass hay .....	.....	.....	.....	3605.45	.....	.....	.....	8075.0

Note: Both lots of steers made much greater gains in 1931 than during the two previous winters. This was due, no doubt, to the very mild winter of 1931. There was only one freeze recorded in Alabama during that winter.

Reference: Alabama Agricultural Experiment Circular 71, pages 5, 6, Table 2, "Wintering Steers in the Black Belt of Alabama," February 1935, Auburn, Alabama.

V

The Value of Johnson Grass Hay for Wintering Steers, When Fed Alone and in Combination With a Small Amount of Cottonseed Meal, at Auburn, Alabama, 1926-32

In the fall of 1926 experiments were started with the object of obtaining information on the value of Johnson grass hay for wintering steers, when fed alone and in combination with a small amount of cottonseed meal. The experiments were conducted on the Kirkwood Plantation, Faunsdale, Alabama, and were continued over a period of seven years. They were divided into three series as follows:

- (1) Johnson grass hay versus Johnson grass hay and cottonseed meal.
- (2) Johnson grass hay and one pound of cottonseed meal versus Johnson grass hay and two pounds of cottonseed meal.
- (3) Johnson grass hay fields with free access to stacked hay.

Johnson Grass Hay Versus Johnson Grass Hay and Cottonseed Meal.

Cattle used—A total of 45 grade Hereford steers were wintered for 112 days on Johnson grass hay alone during the winters of 1926, 1927, and 1928. The hay was self-fed from racks in a barn and the steers were allowed free access to a ten-acre permanent pasture. There were 10 steers on this ration during the first two winters and 25 steers during the third winter.

The gains and losses in the weight of the steers varied considerably in both lots during the different winters. This may have been due largely to a difference in the age and condition of the animals at the beginning of the wintering period. The steers used in 1926 and 1927 were two year old and were thin in flesh while those used in 1928 were long yearlings and were in good flesh. A difference in weather conditions may have also influenced the results although weather records show that several freezes occurred during each of the three winters.

The details of the results of this experiment are given in Table 19.

Table 19—Johnson Grass Hay Alone Versus Johnson Grass Hay and Cottonseed Meal for Wintering Steers at Auburn, Alabama, 1926-28.
(Average 112 days each year)

	Lot 1				Lot 2			
	Johnson grass hay, self-fed from racks				Johnson grass hay, self-fed from racks and cottonseed meal			
	1926	1927	1928	3 yr. av.	1926	1927	1928	3 yr. av.
No. steers wintered	10	10	25	15	10	10	25	15
Av. wintering period (days) ..	112	112	112	112	112	112	112	112
Av. init'l wt. per steer (lbs.) ..	474.00	602.0	600.0	512.44	485.0	619.0	608.0	583.11
Av. final wt. per steer (lbs.) ..	508.0	578.0	513.0	526.33	545.0	686.0	606.0	610.22
Av. gain or loss per steer (lbs.)	34.0	-24.0	-87.0	-46.11	60.0	67.0	-2.0	27.0
Av. daily gain or loss (lbs.) ..	.....	.....	.....	-.41	.....	.....	.....	.24
Av. daily feed per steer (lbs.) ..	.....	.....	.....	.....	.....	.....	.....	.....
Cottonseed meal .....	.....	.....	.....	.....	2.0	2.12	1.75	1.89
Johnson grass hay	19.24	22.42	13.41	16.71	19.21	20.58	13.18	16.16
Feed consumed per 100 lb. gain, lbs.	.....	.....	.....	.....	.....	.....	.....	.....
Cottonseed meal .....	.....	.....	.....	.....	.....	.....	.....	787.51
Johnson grass hay .....	.....	.....	.....	.....	.....	.....	.....	6733.39

Reference: Alabama Experiment Circular 71, pages 1, 4, Table 1, "Wintering Steers in the Black Belt of Alabama," February 1935, Auburn, Alabama.

VI

Range Alone Versus Range Plus Half Ration of Cottonseed Meal and Hulls for Wintering Steers in Sumter County, Alabama. 1909-1910.

The object of this test was to ascertain the value of cottonseed meal and hulls for beef cattle when running on the range. The steers used were two and three year old grades of the Hereford, Shorthorn, Aberdeen-Angus and Red Poll breeds.

They were poor in quality and small in size. Many of them were only half-breed, while some even carried a predominance of scrub blood. They would be classed as common stockers on the market.

The Character of the Range—The cattle were kept in enclosed fields which had been used for growing cotton and corn with some of the range consisting of waste land upon which had been grown native grasses. Crab grass and some Johnson grass had grown up between the rows and furnished some grazing. The corn had been snapped from the stalk and the entire stalk was left in the fields. No cane brakes were available and the cattle which were not fed, had to depend entirely upon the stalks in the cultivated fields and the native grasses.

The cottonseed meal was of 38 per cent protein.

The cattle ran in the enclosed field at all times and were not penned at any time of the day or night. No shelter was provided for them, but during the bad weather they sought natural shelter consisting of plum thickets, rows of hedge trees and hillside nooks which gave them protection from the winter.

The feed was placed in feed-troughs. The cattle were fed once each day just before sundown. Salt was given the animals at feeding time to induce them to come more readily to the feed.

The lots were fed as follows:

Lot 1. Range alone.

Lot 2. Range plus half ration cottonseed meal and hulls.

Details of the experiment are given in the following table.

Table 20—Range Versus Range and Half Ration of Cottonseed Meal and Hulls for Wintering Steers in Sumter County, Alabama, December 8, 1909 to March 9, 1910. 91 Days.

Ration	Lot 1		Lot 2
	Range	Alone	Range plus half ration C. S. Meal and Hulls
No. Steers per lot	33		15
Av. initial weight, lbs.	637		633
Av. final weight, lbs.	531		676
Av. gain or loss per steer	-106		43
Av. daily gain, lbs.	-1.16		.47
Av. daily ration fed, lbs.			
Cottonseed meal			2.4
Cottonseed hulls			8.9
Av. pounds feed required per 100 lb. gain, lbs.			
Cottonseed meal			510.62
Cottonseed hulls			1893.56

Note: The winter of 1909-10 was a severe one and being much colder than the average winter in Sumter County, with a great deal of rain and one hard sleet during December which covered everything with ice for two days. Cold rains and winds made it hard upon the steers.

Reference: U. S. D. A. Bulletin 110, pages 4, 5, 6 and 7, Tables I and II, "Fattening Cattle in Alabama," August, 1914, Washington, D. C.

Suggestive: Was the feeding of cottonseed meal justified in this experiment.

6—THE ADDITION OF COTTONSEED MEAL TO VARIOUS RATIONS

I

The Value of Cottonseed Meal in a Ration Containing Corn Silage, Shelled Corn and Clover Hay for Fattening Two Year Old Steers at Lafayette, Indiana, 1917-18.

The object of this trial was to determine the value of cottonseed meal in a ration containing large amounts of corn silage and shelled corn for fattening two year old steers. The cattle used in this test were selected from a large drove which had been pastured for several months previous. As selected, they were very uniform in weight, quality, age, condition and thrift. Practically all were of Shorthorn breeding. They were divided into lots of 10 steers and fed the following ration:

Lot 4. Cottonseed meal, corn silage, clover hay, shelled corn.

Lot 7. Corn silage, clover hay, shelled corn.

Each lot of steers occupied similar quarters which consisted of an uncovered concreted lot 20x28 feet and an open shed 16x28 feet on the west side. These sheds were kept as well bedded as possible. Owing to the severe winter, with large amounts of ice and snow, the spring thaw caused the open lots to become very sloppy. At all times, however, the cattle had dry beds in the sheds.

The cattle were fed under cover. Water was supplied in galvanized iron troughs adjacent to the pen lots, care being taken to keep the water fresh in these troughs. No method of heating was used but the ice accumulating in the troughs was removed regularly twice daily. The cattle had water before them at all times.

The method of feeding in each lot was practically the same, however, in lot 4, the corn with the cottonseed meal sprinkled over it was fed the first thing in the morning and evening at approximately 6 A. M. and 4:30 P. M. The silage was placed in the troughs after the corn had been consumed. In lot 7, the corn was fed first. The hay was fed once daily, being placed in the hay manger in the morning.

The amount of silage fed in all lots was governed by the appetite of the cattle, the intention was to furnish all the cattle would consume in two hours after being placed in the troughs. The amount of hay was determined by the need of the cattle for dry roughages and their appetite for the hay. Only enough was fed so that the cattle would consume the hay without waste or leaving any appreciable amount.

Salt was given to all lots at as frequent intervals as was required. The cattle were started on feed in the following manner:

At the beginning of the feeding period, the silage was increased as rapidly as the cattle would consume the added amount. The cottonseed meal was fed at the rate of one pound per steer daily and gradually increased until at the end of 10 days the cattle were consuming 2.5 pounds daily per 1000 lbs. live weight. The shelled corn was increased gradually.

Details of the experiment are given in the following table.

Table 21—The Value of Cottonseed Meal in a Ration of Corn Silage, Shelled Corn and Clover Hay for Fattening Two Year Old Steers at Purdue University December 13, 1917 to April 12, 1918. (120 Days).

Ration	Lot 4	Lot 7
	C. S. Meal Silage Hay Shelled Corn	Silage Hay Shelled Corn
No. of steers per lot	10	10
Av. initial wt., lbs.	1047	1044
Av. final wt., lbs.	1335	1259
Av. gain per steer, lbs.	288	215
Av. daily gain per steer	2.40	1.79
Av. daily ration, lbs.:		
Shelled corn	10.73	11.65
Cottonseed meal	2.9	.....
Corn silage	38.29	37.02
Clover hay	4.30	4.27
Feed required per 100 lb. gain, lbs.:		
Shelled corn	448	650
Cottonseed meal	121	.....
Corn silage	1598	2067
Clover hay	179	238

Note: The cattle that were fed cottonseed meal brought a better price than the cattle that received no cottonseed meal because of a better finish.

Reference: Indiana Agricultural Experiment Station 220, pages 5, 6, 7, 8 and 21, Table XIII, "Winter Steer Feeding," 1917-18, Lafayette, Indiana.

Suggestive: How much shelled corn was saved per 100 lbs. by adding cottonseed meal to the ration? How much corn silage was saved per 100 lb. gain? How many more pounds of gain did Lot 4 make than Lot 7? Was the feeding of cottonseed meal justified in this experiment? Which of the two rations would more nearly be classed as a "balanced" ration?

II

The Effect of Cottonseed Meal on the Rate of Gain per Steer When Added to a Ration of Shelled Corn, Silage and Soybean Hay, Purdue University, Lafayette, Indiana, 1931-32.

The cattle used in the trial were grade Montana Herefords, purchased on the Chicago market October 15, 1931. They were grazed on stubble fields containing a good growth of mixed clover and timothy until November 10, when they were brought to the feed lots and allotted according to rations.

The corn and hay fed was of good quality and representative of these feeds as grown in Indiana. Cottonseed meal was guaranteed to contain 41 per cent protein. Silage was well kept but contained less corn than normal silage. It had been harvested at early corn cutting time.

A ration of corn, soybean hay and silage showed some interesting results when compared with a similar ration containing cottonseed meal, viz: a ration of corn, cottonseed meal, silage and clover hay. The rate of gain was slightly below those fed cottonseed meal, and the value of the cattle was also slightly lower than when the cattle were fed the supplementary concentrates; but the cost of

gain was lower and the finish was so nearly the same that the net returns from the cattle were greater where the soybean hay was depended on to furnish the necessary protein to balance the ration of corn and silage. This confirms a trial conducted in the winter of 1925-26, comparing hay, corn and silage with a similar ration containing cottonseed meal. In this previous trial, the rate of gain was slightly lower but the cost of gain was also low enough to overcome any additional gains made by adding cottonseed meal to the ration.

Table 22 Soybean Hay and Cottonseed Meal for Fattening Cattle.

	Lot 3	Lot 4	Lot 5
	Shelled Corn Silage Soybean hay Salt	Shelled Corn Cottonseed Meal Silage Clover Hay Salt	Shelled Corn Cottonseed Meal Silage Soybean Hay Salt
Number animals in lot	10	10	10
Av. initial weight, lbs.	920.0	929.3	930.4
Average final weight, lbs.	1257.3	1274.3	1280.0
Average total gain, lbs.	337.3	345.0	349.6
Average daily gain, lbs.	2.25	2.30	2.33
Total feed consumed, lbs.:			
Shelled corn	21705.	19075.	19080.
Supplements		3472.	3472.
Corn Silage	35610.	35610.	35610.
Roughage	6535.	6865.	6945.
Average daily feed, lbs.:			
Shelled corn	14.47	12.72	12.72
Supplements		2.31	2.31
Corn silage	23.74	23.74	23.74
Roughage	4.36	4.58	4.63
Feed per 100 lbs. gain, lbs.:			
Shelled corn	643.49	552.90	545.77
Supplements		100.64	99.31
Corn silage	1055.74	1032.17	1018.59
Roughage	194.74	198.99	198.66

Reference: Indiana Agricultural Experiment Station Bulletin 296, pages 3 and 4, Table I, "Cattle Feeding," March, 1935, Lafayette, Indiana.

Suggestive: How much average gain did the steers make in each lot? To what can this difference in gain be attributed? Which lot of cattle had the best finish? Which of the rations would be considered as "balanced?"

III

The Effects of Different Proportions of Shelled Corn and Cottonseed Meal on Gains of Beef Steers, Moultrie, Georgia, 1932-33.

Object—In order to study the results of replacing a large percentage of the corn in the fattening ration for cattle with cottonseed meal, feeding experiments were carried on in 1933 by the Experiment Station in cooperation with the United States Department of Agriculture and with the help of Swift and Company at Moultrie, Georgia. Three comparable groups of high grade native yearling steers, 32 head each, were fed. These were mostly Herefords but a number of Angus also were used in this test.

The rations of the three lots consisted of shelled white Georgia corn, cottonseed meal (42 per cent protein), good quality Georgia cowpea hay, steamed bone meal, mineral mixture, and block salt. The mineral mixture was fed only during

the first 28 days of the test and was then replaced with steamed bone meal; it contained ground limestone, hardwood ashes, steamed bone meal, and salt in equal amounts.

Table 23—The Effects of Different Proportions of Shelled Corn and Cottonseed Meal on Gains of Beef Steers, Moultrie, Georgia, 140 Day Test.

November 16, 1932 to April 5, 1933

	Lot 1 1 part c. s. meal to 6 parts corn	Lot 2 1 part c. s. meal to 3 parts corn	Lot 3 2 parts c. s. meal to 3 parts corn
Av. starting weights, lbs.	462.7	461.3	460.1
Av. finishing weights, lbs.	753.8	751.8	740.1
Av. gain per steer, lbs.	291.1	290.5	279.9
Av. daily gain per steer, lbs.	2.079	2.075	2.000
Av. daily feed consumption per steer, lbs.			
Shelled corn	11.22	10.77	8.15
Cottonseed meal	1.89	3.59	4.94
Cowpea hay	4.11	3.86	4.37
Salt, bone meal, and minerals	0.16	0.16	0.16
Av. feed consumed per 100 lbs. gain, lbs.			
Shelled corn	539.78	518.99	407.50
Cottonseed meal	90.67	173.07	246.98
Cowpea hay	197.87	185.91	218.61
Salt, bone meal, and minerals	0.768	0.764	0.804

Note: The results indicate that the heavier rate of cottonseed meal feeding produces as good gains as the lighter rates for a short feeding period (first 12 weeks of test) but that the heavier rate does not give equal results after that time. Previous work has indicated that the unfavorable results from heavy cottonseed meal feeding is partly due to vitamin A deficiency. This could be overcome by allowing yellow corn, some grazing, or hay of green color.

Note: Those steers receiving the heaviest proportion of cottonseed meal failed to develop as good quality, as indicated by the selling price at the close of the experiment, as did those in the two lots receiving the lower proportions of cottonseed meal.

Reference: Georgia Experiment Station, Bulletin 184, Pages 45, 46, 47, Table 6, Experiment, Georgia.

Suggestive: What was the total gain made per steer in each lot? Using the present prices of feeds used in the test, what is the cost per 100 lbs. of gain in Lot 1? Lot 2? Lot 3?

Which combination of cottonseed meal and shelled corn proved to be most profitable?

IV

The Effect of Cottonseed Meal in the Ration for Fattening Two Year Old Cattle at Lafayette, Indiana. 1925-1926.

Object—In order to obtain data on the value of cottonseed meal in a ration of shelled corn, soybean hay, corn silage and salt, the Indiana Experiment Station conducted one trial with two year old cattle under the conditions described below.

The cattle used were two year old steers which were a mixture of reds and roans with fairly good heads, of medium quality and in fair flesh. They were purchased on the Chicago market and fed low grade soybean hay until the test started.

The feeds used: Locally grown corn which contained more moisture than is normally found in corn at such seasons of the year. None of the corn would be graded No. 3. However, it was reasonably free from damaged grain. The cottonseed meal was 41 per cent choice grade. The soybean hay was of good quality with the exception of the last two months when it was coarse and dark. The soybean hay was made from a Manchu variety grown locally. The corn silage was made from well matured corn.

The ration fed each lot was as follows:

Lot 1. Shelled corn, cottonseed meal, soybean hay, corn silage and salt.

Lot 2. Shelled corn, soybean hay, corn silage and salt.

The following table gives the details of the results obtained during this trial.

Table 24—The Effect of Cottonseed Meal in the Ration for Fattening Two Year Old Cattle at Lafayette, Indiana. November 18, 1925, to April 7, 1926. 140 Days.

Ration	Lot 1 C. S. Meal	Lot 2 No C. S. Meal
No. steers per lot	10	10
Av. initial wt. per steer, lbs.	846.3	854.3
Av. final wt. per steer, lbs.	1208.7	1195.3
Av. gain per steer, lbs.	362.4	341.0
Av. daily gain, lbs.	2.59	2.44
Av. total feed consumed, lbs.		
Shelled corn	1773.	1977.
Supplement	333	.....
Corn silage	3276	3426
Hay	607	617
Salt	8	9
Av. daily feed per head, lbs.		
Shelled corn	12.66	14.12
Supplement	2.37	.....
Corn Silage	23.40	24.47
Hay	4.34	4.41
Av. feed required per 100 lb. gain, lbs.		
Shelled corn	489.	580
Supplement	91	.....
Corn Silage	904	1005
Hay	167	181

Note: It was observed that the appetites of the cattle were not materially affected by the addition of the cottonseed meal. After the first two months on feed the cattle receiving corn alone ate enough more corn than those fed both corn and cottonseed meal to equal the latter in total quantity of concentrate consumed. The finish of the cattle was the same in both lots, a fact usually expected in such a comparison.

Reference: Indiana Agricultural Experiment Station Bulletin 330, pages 3, 4 and 15, Table III, "Cattle Feeding," January, 1929, Lafayette, Indiana.

Suggestive: Is the addition of cottonseed meal in the ration of the cattle in Lot 1 justified by the increased gain?

V

The Value of Cottonseed Meal When Used as a Supplement to a Corn, Hay, and Silage Ration for Fattening Two Year Old Steers at Lafayette, Indiana, 1906-08.

The purpose of this experiment was to determine the value of cottonseed meal for the supplement to rations composed of shelled corn, clover hay and corn silage when fattening two year old steers.

The cattle used during 1906-07, were classed as good, heavy, fleshy steers. They were plain, not so blocky and compact as desirable, and showed a tendency to coarseness. They were of common cows and largely sired by Shorthorn bulls, though there were a few Angus and Hereford grades among them.

The cattle used during the 1907-08 test were of the same general type and breeding as those used in 1906-07, but averaged about 110 pounds per steer heavier.

Method of Feeding—The shelled corn was fed at 6 A. M. and 4:30 P. M. in troughs in the open lots. The cottonseed meal was mixed with the grain. After the cattle had cleaned the grain ration thoroughly, which usually required from one-half to three-fourths of an hour, they were fed the roughage in mangers in the open lot. The hay was fed in the morning and the silage in the evening. All fed was limited to such quantities as would be cleaned up readily. Salt was supplied at regular intervals.

The lots in which the cattle were fed were 40x50 feet with an open shed 12x40 feet on the west side of each lot. No bedding was used in the lots. The sheds were kept dry by use of straw. The lots were muddy throughout a greater part of the time covered by the experiment.

The feeds used—The quality of corn used in 1906-07 was fairly good and would be graded No. 3. There was a large amount of rotten grain which was impossible to avoid.

The corn used the second year was inferior in quality, at times very soft and contained a large per cent of moisture. Extreme care was necessary at all times to keep it from heating in the bin.

The cottonseed meal was guaranteed to contain 41 per cent protein.

The clover hay used during the first trial was free from weeds and other grasses, but had been damaged in the stack, frequently showing a streak of white mold, but on the whole a very good quality. In the second test it was impossible to obtain pure clover so a mixture of clover with blue grass and Timothy was fed, estimated at practically two-thirds clover and one-third foreign grasses. The corn silage was an excellent quality during both tests.

The rations fed:

Lot 1. Shelled corn, cottonseed meal, clover hay and corn silage.

Lot 2. Shelled corn, clover hay and corn silage.

Details of the experiment are given in the following table.

Table 25—The Value of Cottonseed Meal as a Supplement to Shelled Corn, Clover Hay and Corn Silage for Fattening Two Year Old Steers at Lafayette, Indiana. 1906-08. Average of 2 Trials. Average Length of Each Trial—165 Days.

Ration	Lot 1	Lot 2
	C. S. Meal	No C. S. Meal
No. of steers per lot	10	10
Av. initial weight, lbs.	1066	1069
Av. final weight, lbs.	1501	1372
Av. gain per steer, lbs.	434	302
Av. daily gain, lbs.	2.63	1.82
Av. daily ration, lbs.:		
Shelled corn	17.8	16.8
Cottonseed meal	2.8	.....
Clover hay	4.4	4.5
Corn silage	15.5	15.5
Av. feed required per 100 lb. gain, lbs.		
Shelled corn	675.	950.
Cottonseed meal	110.	.....
Clover hay	175.	250.
Corn silage	585.	820.

Note: The cattle receiving cottonseed meal attained a higher finish, distributed fat more evenly over the carcass, and had a higher market value than those that did not receive cottonseed meal.

Reference: Indiana Agricultural Experiment Station Bulletin 129, pages 236, 238, 265 and 266, Table VIII, "Winter Steer Feeding," October, 1908, Lafayette, Indiana.

Suggestive: Was there any difference in total gain per steer in the two lots? Which lot required the most shelled corn per 100 lb. gain? Which ration would net the greater return per steer?

VI

The Value of Cottonseed Meal When Used as a Supplement to Shelled Corn and Clover Hay for Fattening Two Year Old Steers at Lafayette, Indiana, 1907-09.

The object of this trial was to ascertain the value of cottonseed meal in a corn and hay ration for fattening two year old steers.

The cattle used in this trial were of good, heavy, fleshy feeder type. They were plain, fairly compact and showed a tendency to coarseness. They were from common cows and largely sired by Shorthorn bulls, though there were a few Angus and Hereford grades among them.

Method of feeding—The shelled corn was fed at 6 A. M. and at 4:30 P. M. in troughs in the open lots. The cottonseed meal was mixed with the grain. After the cattle had cleaned up the grain ration they were fed the clover hay in mangers in the open lot in the morning. All feeds were limited to such quantities as would be cleaned up readily. Salt was supplied at regular intervals.

Feeds used—The corn used in 1907-08 was inferior in quality, at times very soft and contained a large per cent of moisture. In 1908-09, the quality of corn was exceptionally good. It was free from mould and chaff, and would have graded No. 2.

The cottonseed meal used in 1907-08 and 1908-09 was guaranteed to contain 41 per cent protein.

The clover hay used in 1907-08 was not pure. It contained a mixture of two-thirds clover and one-third foreign grasses. The clover hay used in 1908-09 was of very good quality, free from weeds and foreign grasses and of good color.

The lots in which the cattle were fed were 40x50 feet with an open shed on the west side of each lot. No bedding was used in the lots, but the sheds were kept dry by means of straw. The lots were muddy throughout a greater part of the experiment.

The ration fed each lot was as follows:

Lot 1. Shelled corn and clover hay.

Lot 2. Shelled corn, cottonseed meal and clover hay.

Details of the experiment are given in the following table.

Table 26—The Value of Cottonseed Meal as Supplement to Corn and Clover Hay for Fattening Two Year Old Steers at Lafayette, Indiana. An Average of Two Trials. Average Length of Each Trial—166 Days.

Ration	Lot 1	Lot 2
	Shelled Corn Clover Hay	Shelled Corn Clover Hay C. S. Meal
No. of steers per lot	10	10
Av. initial weight, lbs.	1042	1048
Av. final weight, lbs.	1356	1448
Av. gain per steer, lbs.	314	400
Av. daily gain, lbs.	1.89	2.43
Av. daily ration, lbs.		
Shelled corn	19.08	18.52
Clover hay	9.90	9.62
Cottonseed meal		2.81
Average feed required per 100 lb. gain, lbs.		
Shelled corn	1002.	758
Clover hay	518	392
Cottonseed meal		116

Note: The cattle receiving cottonseed meal attained a higher finish, distributed fat more evenly over the carcass, and had a higher market value than those that did not receive cottonseed meal.

Reference: Indiana Agricultural Experiment Station Bulletin 129, pages 236, 237, 238, 271, Table IX, "Winter Steer Feeding," October, 1908, Lafayette, Indiana.

Suggestive: How much more average gain was made per steer in Lot 2 than in Lot 1? Was the feeding of cottonseed meal in Lot 2 justified? Which of the rations would be considered to be more nearly a "balanced" ration?

VII

Cottonseed Meal Combined with Various Rations for Fattening Beef Calves at Stillwater, Oklahoma, 1927-28.

Cattle used—Fifty high grade Hereford calves were secured from the Matador Land & Cattle Company ranch in Texas and were delivered in Stillwater on November 8th. These calves were carefully sorted as to size, weight, conformation and quality and were placed on feed on November 16th.

The primary objects of this test were as follows:

1st. To study various rations when combined with cottonseed meal for fattening steer calves.

2nd. To determine the amount of cottonseed meal that can be used profitably and safely in the fattening ration for calves.

3rd. To determine the advisability of adding ground limestone to the ration.

4th. To determine if it is advisable to substitute prairie hay for alfalfa hay when a heavy ration of meal and limestone is used.

5th. To determine the advisability of substituting cottonseed meal pound for pound for corn.

The 50 head of steer calves were divided into five lots of ten each and to be continued on feed for 200 days on daily rations as follows:

Lot 1. Ground corn, cottonseed meal 1½ lbs., alfalfa hay, and ground limestone 2% of grain ration.

Lot 2. Ground corn, cottonseed meal 2½ lbs., alfalfa hay and ground limestone 2% of grain ration.

Lot 3. Ground corn, cottonseed meal 3½ lbs., alfalfa hay and ground limestone 2% of grain ration.

Lot 4. Ground corn, cottonseed meal 2½ lbs., alfalfa hay.

Lot 5. Ground corn, cottonseed meal 2½ lbs., prairie hay and ground limestone 2% of grain ration.

Table 27—Effect of Various Rations With Cottonseed Meal Compared for Fattening Beef Calves, Stillwater, Oklahoma. Nov. 16, 1927 to June 3, 1928. (200 Days).

Lot	I	II	III	IV	V
No. steers per lot	9*	10	10	10	10
Av. initial weight	314.2	310.8	309.3	317.5	326.1
Av. final weight	718.8	678.	705.	695.	703.
Av. daily gain	2.02	1.83	1.98	1.89	1.88
Total concentrates per steer	9.43	9.40	9.43	9.52	9.43
Average Daily Ration:					
Ground corn	8.15	7.39	6.66	7.5	7.39
Cottonseed meal	1.28	2.01	2.77	2.02	2.04
Alfalfa hay	4.3	4.29	4.29	4.27	
Prairie hay					4.28
Ground limestone	.16	.15	.14		.15
Feed per 100 lbs. gain:					
Grain	576.2	631.2	586.3	607.6	616.9
Hay	194.	211.3	211.3	203.4	194.1
Dressing Percentage	55.5	57.7	56.3	56.4	55.9

*Steer No. 14, Lot 1, died from pneumonia on February 15th.

Note: The steers in all the lots were light weight at the beginning and did not make the daily gains in the early part of the period that would have been possible had these steers been 50 pounds heavier at the start.

The steers in all lots were fed according to appetite. As the amount of cottonseed meal was increased, the amount of corn was held down in proportion. Therefore, the total amount of concentrates remained approximately the same in each lot.

Reference: Oklahoma Agricultural Experiment Station Bulletin 179, pages 1, 2 and 6, "Beef Cattle Feeding Investigations," June 1928, Stillwater, Oklahoma.

Suggestive: How much did calves in Lot 1 gain? What is the average gain per steer in Lots 4 and 5? What difference is there in the rations of Lots 4 and 5? Which of the five lots required the least amount of feed to make 100 lbs. of gain? Which ration would you feed to fattening calves?

VIII

**Cottonseed Meal Fed in Varying Amounts to Steer Calves at Stillwater,
Oklahoma, 1930-31.**

The primary objects of this test were to study various rations when combined with cottonseed meal for fattening steer calves; to determine the amount of cottonseed meal that can be used profitably in the fattening ration for calves; to determine the advisability of adding ground limestone to the ration; to determine the advisability of feeding ground shelled corn and prairie hay without a protein supplement; and to determine the advisability of substituting cottonseed meal, pound for pound, for corn.

The calves for this experiment were carefully sorted as to size, weight, conformation and quality, and were placed on feed November 17, 1930. The calves were divided 10 to each lot.

The rations fed:

Lot 1. Ground shelled corn, full fed; cottonseed meal, 1½ lbs.; prairie hay; and ground limestone, 2% of the grain ration.

Lot 2. Ground shelled corn, full fed; cottonseed meal, 2½ lbs.; prairie hay; and ground limestone, 2% of the grain ration.

Lot 3. Ground shelled corn, full fed; cottonseed meal, 3½ lbs.; prairie hay; and ground limestone, 2% of the grain ration.

Lot 4. Ground shelled corn, full fed; cottonseed meal, 2½ lbs.; prairie hay.

Method of feeding: The steers in all lots were fed according to appetite. As the amount of cottonseed meal was increased, the amount of corn was held down in proportion. Therefore, the total amount of concentrate remained approximately the same in the first four lots.

**Table 28—Results of Feeding Cottonseed Meal to Fattening Steers in Varying
Amounts at Stillwater, Oklahoma, 1930-31.**

Ration	Lot 1	Lot 2	Lot 3	Lot 4
	1½ lbs. C. S. Meal	2½ lbs. C. S. Meal	3½ lbs. C. S. Meal	2½ lbs. C. S. Meal
No. of steers per lot	10	10	10	10
Av. initial weight, lbs.	399	399	397.5	398.5
Av. final weight, lbs.	759.8	763.08	773.06	754.38
Av. gain per steer, lbs.	360.8	364.08	375.56	355.88
Av. daily gain, lbs.	2.2	2.22	2.29	2.17
Av. daily ration, lbs.:				
Ground shelled corn	9.62	8.66	7.66	8.67
Cottonseed meal	1.50	2.47	3.60	2.47
Prairie hay	5.23	5.13	5.14	5.09
Limestone (gr.)	.20	.17	.15	.....
Total concentrates per head, lbs.	11.12	11.13	11.26	11.14
Feed required to produce 100 lbs. gain, lbs.:				
Concentrates	505.	501.	493.	513.
Roughage	237.	231.	225.	234.

Note: There were no ill effects from the use of cottonseed meal in any of the lots during the 164-day feeding period.

Reference: Oklahoma Agricultural Experiment Station Report 1930-32, pages 81, 82 and 83, Table XXIV, "Solving Oklahoma Farm Problems," Stillwater, Oklahoma.

Suggestive: What amount of cottonseed meal gave the fastest gain? What amount gave the slowest gain? Which lot required the least amount of feed to make 100 lbs. of gain? How much meal was fed daily in this lot?

IX

Fifteen Pounds Silage and Two Pounds Cottonseed Meal Versus Thirty Pounds Silage and One Pound Cottonseed Meal for Fattening Two Year Old Cattle at Knoxville, Tennessee. 1914-16.

The purpose of this experiment was to compare silage and cottonseed meal when fed in varying proportions to two year old cattle.

The equipment used in this experiment was a barn 74x40 feet with stabling below and a loft for hay above. The silage was stored in a wood-hoop silo 12x28 feet.

The cattle used in this experiment were poor to medium market grade classes of Herefords and Shorthorns.

The feed used in this experiment was described as follows:

The silage was made from corn and sorghum with the sorghum predominating, and the corn well-eared but immature and was put into the silo generally before frost. The cottonseed meal was 36 per cent protein meal.

When the cattle were put on feed in the fall, the feeds were weighed for a few days until it was known what the measures held and thereafter they were fed like amounts by measure. The cattle were stabled in pens in the barn during the night and when stormy during the day. Manure was hauled from time to time during the winter when the weather permitted. When an animal was sick, it was isolated and given a pound of Epsom Salts. The cattle obtained water when let out of the pens each day. In the fall of each year, they were put on full feed immediately after weighing.

The cattle were divided into lots and fed as follows:

Lot 2. 15 pounds silage, 2 pounds cottonseed meal.

Lot 3. 30 pounds silage, 1 pound cottonseed meal.

In addition to the above winter ration, cattle from each group were allowed the run of the range during the day when the weather was fair.

Table 29—Fifteen Pounds Silage and Two Pounds Cottonseed Meal Versus Thirty Pounds Silage and One Pound Cottonseed Meal for Fattening Two Year Old Cattle at Knoxville, Tennessee. A Two Year Average 1914-15 and 1915-16.

Ration	Lot 2	Lot 3
	15 lbs. silage 2 lbs. cottonseed meal	30 lbs. silage, 1 lb. C. S. meal
No. of head per lot	7	7
Av. initial wt. lbs.	579	598
Av. final wt., lbs.	903	899
Av. gain per head, lbs.	324	301
Av. daily gain per head, lbs.	1.2	1.1
Av. daily ration, lbs.:		
Silage	15	30
Cottonseed meal	2	1
Feed required per 100 lb. gain, lbs.:		
Silage	1250	2727
Cottonseed meal	166.6	90.9

Reference: Tennessee Agricultural Experiment Station Bulletin 125, pages 49, 50, 51 and 53, Tables 1 and 2, "Stocker Cattle Problems On The Cumberland Plateau," June, 1921, Knoxville, Tennessee.

Suggestive: Assuming that you could get the same results from feeding silage and cottonseed meal as indicated in the above experiment, could you afford to double the proportion of silage to cottonseed meal?

X

The Value of a Small Amount of Cottonseed Meal When Added to the Ration for Wintering Steers in Greenbrier County, West Virginia. 1914-18.

The objects of the experiments were to ascertain the effect of different rations upon subsequent pasture gains and to determine the most economical method of wintering beef steers.

The steers used in these experiments were of grade Shorthorn, Hereford and Aberdeen-Angus breeding. They were raised in Southern West Virginia and were a good uniform lot of cattle in age, weight, quality and condition.

The feeds used: Cottonseed meal was 41 per cent protein the first year and 36 per cent protein the last three years. The corn silage was made from a mixture of dent and silage corn. The mixed hay used was a mixture of timothy and clover.

The pasture used: About 160 acres of rather rough land, $\frac{1}{4}$ of which was in wood-land, was used for pasture. It was situated in a valley between two mountains and a small stream which flowed through it provided an abundance of water at all times throughout the summer.

Method of Feeding—In the fall before starting the steers on winter feed, they were divided into lots of 10 each. In this division care was taken to have the lots as nearly the same as possible in regard to quality, breeding, size and condition. The cattle were fed twice a day.

The lots were fed the following rations:

Lot 1. Corn silage, mixed hay and wheat straw.

Lot 2. Corn silage, wheat straw and cottonseed meal.

Lot 3. Mixed hay and wheat straw.

Details of the experiment are given in the following table.

Table 30—The Value of Cottonseed Meal When Used in the Ration for Wintering Beef Cattle in Greenbrier County, West Virginia. 1914-1918.—4 Year Average. Average Length of These Trials—129 Days.

Ration	Lot 1	Lot 2	Lot 3
	Corn Silage Mixed Hay Wheat Straw	Corn Silage Wheat Straw C. S. Meal	Mixed Hay Wheat Straw
No. of steers per lot	10	10	10
Av. initial weight, lbs.	663	664	665
Av. final weight, lbs.	662	726	630
Av. gain or loss per steer, lbs.	-1	62	-35
Av. daily gain or loss, lbs.	-.01	.48	-.46
Av. daily ration, lbs.			
Corn silage	19.8	22.9	
Mixed hay	5.		11.9
Wheat straw	2.5	4.9	4.1
Cottonseed meal		1.	
Av. feed required per 100 lb. gain, lbs.:			
Cottonseed meal		208.	
Corn silage		4763	
Wheat Straw		1019	
Av. summer gain per steer on pasture alone.	317.	262	309.

Reference: U. S. D. A. Bulletin 870, pages 3, 4, 5, 6, 7, 8 and 9, Tables IV, V and VI, "The Effect of Winter Rations on Pasture Gains of Yearling Steers," November, 1921, Washington, D. C.

Suggestive: What was the average gain in each lot? What is the difference in the ration of Lot 1 and Lot 2? Was the increase in gain in Lot 2 per steer enough to justify the feeding of cottonseed meal?

7—COTTONSEED MEAL AND HULLS VERSUS THE ADDITION OF SOME OTHER CONCENTRATES

I

A Ration of Cottonseed Meal and Cottonseed Hulls Versus a Mixed Ration of Cottonseed Hulls, Hay, Corn Meal, Cottonseed Meal and Wheat Bran for Fattening Beef Cattle at State College, Mississippi. 1905.

The purpose of this test was to ascertain the value of cottonseed meal and cottonseed hulls as a beef cattle feed when compared with a well balanced ration of other feeds.

Cattle Used—The cattle used in this experiment were grade Shorthorns and Angus. They were all in good thrifty condition when purchased and would have been classed as medium feeders. Their ages ranged from two to four years. The four year old steers were fairly well finished when the experiment was begun and consequently made very poor gain.

Method of Feeding—All the cattle were fed twice a day at 6 A. M. and at 5 P. M. The troughs were cleaned out every time before feeding and the feeds

were weighed and the weights recorded. The roughage, hay and hulls were fed first, then the meal which was thoroughly mixed with it.

The lots receiving cottonseed meal and hulls had their ration divided equally between the two feeds, i. e., 13 to 15 pounds of hulls and 3 to 4 pounds meal at each feeding. Those receiving the mixed ration were given hulls in the morning and hay at night. During the first period, which was 32 days, 3 pounds of cottonseed meal was fed with the hulls and 2 pounds each of corn meal and bran with the hay.

In the second period, which was 28 days, 2 pounds each of cottonseed meal and bran were fed with the hulls and 5 pounds corn meal with the hay.

In the third period, which was 34 days, the corn meal fed at night was increased 1 pound daily up to 10 pounds and 2 pounds corn meal was fed in the morning along with 2 pounds cottonseed meal and bran, making a total of 12 pounds corn meal per day.

Feeds Used—The cottonseed meal and hulls used in this test were of good quality. The hay used during the first two feeding periods was about two-thirds alfalfa and one-half Johnson grass, but during the third feeding period, only second class Johnson grass hay could be obtained. The corn meal used was the best store meal and the wheat bran was a good quality.

Water was kept before the cattle at all times.

The steers were divided as nearly equal as possible in regard to age, quality and size, and fed the following rations:

Lot 4. Cottonseed hulls, mixed hay, corn meal, cottonseed meal and wheat bran.

Lot 5. Cottonseed hulls and cottonseed meal.

Details of the experiment are given in the following table.

Table 31—A Ration of Cottonseed Meal and Hulls Versus a Ration of Cottonseed Meal and Hulls, Corn Meal, Wheat Bran and Mixed Hay for Fattening Beef Cattle at State College, Mississippi. January 8 to April 11, 1905.
Length of Test—94 Days.

Ration	Lot 4 Mixed Ration	Lot 5 C. S. Hulls C. S. Meal
No. of steers per lot	5	5
Av. initial weight, lbs.	871	974
Av. final weight, lbs.	1067	1119
Av. gain per steer, lbs.	196	146
Av. daily gain, lbs.	2.08	1.52
Av. daily ration, lbs.		
Cottonseed meal	2.3	6.7
Cottonseed hulls	13.72	28.1
Mixed hay	9.6	.....
Corn meal	6.2	.....
Wheat bran	2.1	.....
Feed required per 100 lb. gain, lbs.		
Cottonseed meal	120	442
Cottonseed hulls	658	1854
Mixed hay	460	.....
Corn meal	297	.....
Wheat bran	100	.....

Note: The steers in Lot 5 did not have shelter protection while those in Lot 4 had a shelter in one end of the lot. This was the only difference in feed lot conditions between the two lots.

Reference: Mississippi Agricultural Experiment Station Bulletin 92, pages 3, 4, 6, 8, 20 and 21, "Feeding Beef Cattle in Mississippi," August, 1905, State College, Mississippi.

Suggestive: How does the gain made per steer in the two lots compare? Was the cost per 100 lbs. gain in Lot 4 as economical as the gain in Lot 5? Calculate on basis of present feed prices. Is a complex ration more efficient than a simple ration?

8—COTTONSEED MEAL VERSUS MISCELLANEOUS PROTEIN CONCENTRATES

I

Cottonseed Meal Versus Old Process Linseed Meal Fed in Conjunction With Native Hay for Fattening Beef Steers, Laramie, Wyoming, 1920-1921.

Thirty-six high-grade range Hereford steers from the Gunnison district of Colorado were selected in the stockyards of Denver, January 19, 1920. These cattle were remarkably uniform in all particulars. They were classed as long yearlings and were graded as choice feeders. These were two-year-old steers at this time and had been run together on an upland pasture for 5 months during the summer.

The cattle were divided into 4 groups with due regard to uniformity in type, thrift, weight, breeding and quality. No attention was paid to any previous allotment. All groups were then placed on a preliminary feed for 21 days in order that they might become accustomed to dry lot feeding and to the feeds used.

Group I received a full feed of native hay and about 2.5 pounds cottonseed meal per steer.

Group II was fed the same amount of native hay as check Group I and the same amount of old process linseed meal as was fed of cottonseed meal to Group I.

Group III received one-half the amount of native hay consumed by the check group and the same allowance of cottonseed meal and a full feed of sunflower silage. Group IV was given identically the same ration as Group III due to the fact that oat and pea silage was not available during the preliminary feeding period.

The hay was fed to all groups in a large rack holding several days' allowance. The cottonseed meal was fed to Group I and the linseed meal to Group II in large feed bunks about 10:00 a. m. each day.

The hay used came from Robert Martin's ranch north of Laramie. It was a very high grade of hay but contained a large percentage of broadleaf grasses and less of the wheat grasses than the hay used in the former trial. There was a tendency for the cattle in Groups I and II to scour more or less throughout the test, probably due to the high ash content of the hay. The high ash content was probably due in part to external deposits of alkaline salts arising from evaporation of irrigation water from the grass plants. The hay was baled from the stack and hauled in as used in the experiment.

The cattle were confined to the lots throughout the entire trial, except when driven out to the scales, which were located at the end of a lane adjoining the shed.

Table 32—Cottonseed Meal Versus Linseed Meal for Fattening Steers When Fed With Native Hay, Laramie, Wyoming, 1920-1921.

	Group I Native Hay, Cotton- seed Meal	Group II Native Hay, Linseed Meal
Steers per group	4*	4*
Average initial weight, lbs.	1022.22	1014.58
Average final weight, lbs.	1182.65	1129.36
Average gain per steer, lbs.	160.43	104.78
Average daily gain per steer, lbs.	1.63	1.08
Daily ration fed, lbs.:		
Native hay	25.00	25.00
Sunflower silage .....	.....	.....
Out and pen silage .....	.....	.....
Cottonseed meal	3.44	.....
Linseed meal .....	.....	3.44
Total feed consumed daily, lbs.	28.44	28.44
Feed consumed per 100 lbs. gain, lbs.:		
Native hay	1606.36	2260.65
Sunflower silage .....	.....	.....
Out and pen silage .....	.....	.....
Cottonseed meal	207.22	.....
Linseed meal .....	.....	321.34

*One steer was added to each group Dec. 14, making a total of 5.

Note: Results obtained in Group III and IV have been omitted from the table because only silage comparisons are made.

Reference: Wyoming Agricultural Experiment Station Bulletin 128, pages 60, 68, 69, 70 and 72, Table IV, "Homegrown Feeds for Range Steers," June, 1921, Laramie, Wyoming.

Suggestive: How much more did each steer gain in Lot I than they did in Lot II? Based on the results of this test, how much more is a ton of cottonseed meal worth than a ton of linseed meal?

II

Cottonseed Meal Compared with Cold Pressed Cottonseed and Peanut Meal for Supplementing a Ration Composed of Ground Milo, Corn or Sorghum Silage, and Sudan Hay for Fattening Calves at College Station, Texas, 1915-1916.

The object of this test was to compare the value of cottonseed meal, cold pressed cottonseed and peanut meal as a protein supplement.

High grade Aberdeen-Angus steer calves were used in the experiment. They were quite uniform and, as a whole, a choice lot of feeders. Being, for the most part, March and April calves they were from six to eight months old when on November 2 they were weaned and shipped to College Station.

The experiment was not begun immediately, and the calves were fed together from the day they arrived until December 18, their ration consisting of cold-pressed cottonseed, ground milo, corn silage, and Sudan hay. There was no trouble whatever in getting them on feed. After the first few days they were fed all the roughage (silage and hay) they would eat but the amount of concentrates (cake and milo) was kept low until after the experiment started.

On December 12 and for several days previous, the ration per head daily was 2 pounds cold-pressed cottonseed, 2 pounds ground milo, 14 pounds silage, and 3 pounds Sudan hay.

On December 13 the calves were divided into three lots of twelve each, the effort being made to have the lots as similar to each other as possible with respect to weight, conformation, quality and condition. Each lot was then started on the ration it was to receive during the experiment. The feeds constituting the rations fed were as follows:

Lot 1. Cottonseed meal, ground milo, corn silage, and Sudan hay.

Lot 2. Peanut meal, ground milo, corn silage, and Sudan hay.

Lot 3. Cold-pressed cottonseed, ground milo, corn silage, and Sudan hay.

Each lot of calves was subjected to the same conditions throughout the experiment except in respect to the rations. Each lot occupied a pen 60x100 feet and had access to a shed open on the south side. Water from a deep well was supplied in galvanized iron troughs in the open pen, and granular salt in small wooden troughs under the shed, so that the calves had free access to both at all times. The hay racks were under the shed, but the troughs for the concentrates and silage were in the open. Except in the case of hay, all feeds were supplied regularly twice daily, early in the morning and late in the afternoon, the rations being divided between the two feeds. The concentrates and silage were thoroughly mixed together by hand in the troughs. The hay was placed in the racks in the morning, a sufficient quantity being allowed for the whole day.

Table 33—Cottonseed Meal Compared with Cold-Pressed Cottonseed and Peanut Meal for Fattening Calves at College Station, Texas. Length of Test—201 Days. December 20, 1915 to July 8, 1916.

	Lot 1	Lot 2	Lot 3
	C. S. Meal	Peanut Meal	Cold Pressed Cottonseed
No. of calves	12	12	12
Av. initial weight, (lbs.)	475	465	476
Av. final weight at College Station (lbs.) ..	801	772	792
Av. gain per head (lbs.)	326	307	316
Av. daily gain per head (lbs.)	1.62	1.52	1.57
Net shrinkage, per cent	6.1	3.88	4.41
Av. daily ration (lbs.) :			
Meal or cake	1.89	3.77	3.77
Ground milo	8.23	8.21	8.21
Silage (corn or sorghum)	13.72	10.60	12.35
Sudan hay or cotton seed hulls	2.27	1.11	1.14
Feed required for 100 lb. gain (lbs.) :			
Meal or cake	116.54	247.18	240.14
Ground milo	507.59	538.11	522.78
Silage (corn or sorghum)	846.16	694.38	785.54
Sudan hay or cotton seed hulls	140.03	73.16	72.84
Blackstrap molasses	1.99	2.11	2.05

Note: The following report was given by Armour & Company: "In judging these lots from a beef standpoint, Lot 3 was first choice. The cattle in this lot were thicker and filled out better, had a very good cover, a good color, and a larger percentage of fat. Lot 2, second choice, were very good cattle, with a possible exception of two off cattle in the lot, which had not done as well as the

balance. They had a very good color, white fat, and showed a smoother finish than any of the other lots. However, they were not as thick, nor did they make the percentage of beef as Lot 3. Lot 1 was a third choice, had a higher color, and the fat was not as white as other lots. In summing up the total, however, taking all lots together, they were a very desirable kind of beef for this territory, and were about as even a bunch as we ever get."

Reference: Texas Agricultural Experiment Station Bulletin 198, pages 5, 8, 9, 15, and 17, Table VI, "Feeding Baby Beeves," November, 1916, College Station, Texas.

Suggestive: Which lot required the least amount of supplement to make 100 pounds of gain? What is the relative cost per 100 pound gain in each lot?

9—COTTONSEED MEAL VERSUS COTTONSEED

I

Silage Compared With Cottonseed Hulls, and Cottonseed Meal Compared With Cottonseed for Fattening Cattle at College Station, Texas, 1912-13.

The purpose of this experiment was to make a comparison of silage and cottonseed hulls in conjunction with cottonseed meal for fattening cattle, and to ascertain the relative values of cottonseed meal and cottonseed as supplements to silage.

The plan of the experiment is as follows: The morning of October 16, 1912, the steers were divided into four lots of 7 head each, (only Lots 1, 2 and 4 will be used in this report), the lots being designated as Lots 1, 2, 3 and 4. The division was made as equally as possible with regard to breed, conformation, quality, condition and weight.

The cattle used were well graded Shorthorn and Hereford steers, 19 head of Shorthorn and 9 of the Hereford, and were two years past in age. Most of them were of average quality and of very good feeder conformation. Eight of them were rather narrow, shallow bodied and leggy, and hence, noticeably inferior to the others. All were rather thin in flesh but in good thrift when the experiment began.

The greater portion of the cottonseed meal used was below prime grade. The other feeds were of very good quality. The silage fed during the first 107 days of the test was composed of sorghum and cowpeas and that fed during the remaining days (32) of Indian corn. It was estimated that the former contained about 90 per cent sorghum and 10 per cent cowpeas.

The pens in which the steers were confined were 60x100 feet in area, had neither sheds nor wind breaks, and hence, were entirely unprotected from the weather. Water from a deep well was kept before the cattle at all times. The cattle had free access to granular salt throughout the test.

The day's rations for each lot was carefully weighed and divided into two equal parts, one part being fed early in the morning and the other late in the afternoon. The feeds composing each ration were thoroughly mixed in the feed troughs.

Weights of the cattle were taken at intervals of every 30 days throughout the test.

The experiment covered a period of 139 days, from the evening feed of October 16, 1912, to the morning feed of March 4, 1913.

The day's ration per steer for each lot at the beginning was as follows:

Lot 1. Two pounds cottonseed meal, 20 pounds cottonseed hulls.

Lot 2. Two pounds cottonseed meal, 24 pounds silage.

Lot 4. Three pounds cottonseed, 24 pounds silage.

After only a few days taken to get the cattle accustomed to their feed, the hulls and silage were rapidly increased, as much being given them as was readily consumed. It was noticeable that from the beginning, and in fact, throughout the experiment that Lot 2, receiving meal and silage, ate their feed with much more relish than did Lot 1 receiving meal and hulls.

In getting the cattle to full feed, the cottonseed meal and the cottonseed were increased at much slower rate than was the roughage portion of the rations.

The feeds were gradually increased in each lot by periods—the first four periods were of 30 days each, the last period was only 19 days. The average daily ration per steer for the first 30 days was as follows:

	Lot 1	Lot 2	Lot 4
Cottonseed meal	2.6	2.6	.....
Cottonseed hulls	22.6	.....	.....
Silage .....	.....	42.3	37.4
Cottonseed .....	.....	.....	4.1

and the average daily ration received per steer for the last 19 day period was as follows:

	Lot 1	Lot 2	Lot 4
Cottonseed meal	6.	6.	5.6
Cottonseed hulls	30.	.....	.....
Silage .....	.....	52.	49.2
Cottonseed .....	.....	.....	.56

Table 34—Cottonseed Hulls Versus Silage as a Roughage for Steers at College Station, Texas, October 12, 1912 to March 4, 1913

	Lot 1 Cottonseed meal Cottonseed hulls	Lot 2 Cottonseed meal Silage	Lot 4 Cottonseed Silage (Cottonseed meal)
No. steers per lot	7	7	7
Av. initial wt. at feed lot, lbs.	864.2	837.8	825.7
Av. final wt. at feed lot, lbs.	1227.	1156.	1140.
Av. gain per head feed lot, wt., lbs.	362.8	318.5	314.2
Av. daily gain feed lot wt., lbs.	2.61	2.29	2.26
Shrinkage per head during shipment, lbs.	177.	105.	107.
Av. daily ration fed, lbs.:			
Cottonseed meal	4.2	4.2	.....
Cottonseed hulls	28.4	.....	.....
Silage .....	.....	50.9	44.42
Cottonseed .....	.....	.....	6.3
Feed consumed per 100 lb. gain, feed lot wt., lbs.			
Cottonseed meal	157.1	178.9	34.2
Cottonseed hulls	1081.3	.....	.....
Silage .....	.....	2217.9	1948.4
Cottonseed .....	.....	.....	244.7
Total feed consumed per head, lbs.:			
Cottonseed meal	569.9	569.9	107.5
Cottonseed hulls	3923.6	.....	.....
Silage .....	.....	7065.6	6123.6
Cottonseed .....	.....	.....	769.1

Note: During the last 19 day period of the test, the steers in Lot 4 were fed only .56 lbs. of cottonseed, but 5.6 lbs. of cottonseed meal was substituted for the cottonseed. A very noticeable condition existed, especially in Lot 1 and to a lesser degree in the other. Throughout the experiment the cattle consumed lots of salt and drank a great deal of water, more than in Lot 2. Though this is attributed, of course, to the drier character of the rations on which they were fed, it is nevertheless, a point of much importance from the fact that it very likely had much to do with the somewhat greater gains they made as well as the greater shrinkage they sustained in shipment to market. Weather conditions were quite severe during much of the experiment. It rained a great deal during December and January and the wind and cold were quite severe during much of that period. The pens became very muddy and the cattle were therefore kept from lying down much of the time.

Reference: Texas Agricultural Experiment Station Bulletin 159, pages 5, 8, 9, 10, 11, 12, 16, 17, Tables VII and IX, "Steer Feeding," July, 1913, College Station, Texas.

Suggestive: What was the average daily gain in Lot 1? In Lot 2? How much cottonseed meal was required per 100 lbs. in Lot 1? In Lot 2? Which lot made the most economical gains? Did cottonseed economically replace some of the cottonseed meal in Lot IV? If you had a group of steers to feed, and had studied this experiment, what roughage would you use?

SECTION B—COTTONSEED CAKE AS A CONCENTRATE

1—COTTONSEED CAKE AS A SUPPLEMENT TO PASTURE

I

The Value of Cottonseed Cake When Used as a Supplement to Pasture for Fattening Steers in Clay and Madison Counties, Miss., 1915 and 1916.
(1915)—Clay County

The purpose of this test was to obtain additional data concerning the fattening of steers on summer pasture in the South. The steers were placed on pasture in the spring and fattened for early fall market. Owing to the high price of corn at Abbott in the spring of 1915 only two lots were used.

Forty steers were divided into 2 lots of 20 each and fed as follows: Lot 1, 20 steers, pasture alone; Lot 2, 20 steers, pasture and cottonseed cake.

Cattle used: The 40 steers in this experiment were ordinary natives of mixed and inferior breeding. Jersey blood predominated in all but a few, which showed evidences of Angus and Shorthorn blood. They had been wintered on cottonseed meal, cottonseed hulls, and corn silage, and were in good condition when the experiment began, averaging 678 pounds.

The cottonseed cake which was fed to the steers of Lot 2 was of high quality, analyzing 43 per cent crude protein.

Owing to a dry period early in the spring of 1915 the pastures were not ready for use until late in May, and in midsummer a drought of two months' duration almost ruined the pastures for the season. Rains during the latter part of August also injured them somewhat. Owing to these unsatisfactory conditions good gains on the cattle could hardly be expected.

The cottonseed cake was fed each evening about sundown in troughs placed in the pasture. Pools in the open pastures furnished the only source of water supply for the steers, and became very low and foul during the extended dry period. Salt was provided each week.

The average daily ration of cottonseed cake for the steers of Lot 2 was 3.65 pounds each. They were given 2 pounds per head daily at the beginning, which was gradually increased during the first months to 4 pounds. This allowance was continued until the end of the experiment.

(1916)—Madison County

The series of experiments in fattening steers on summer pasture was continued in the summer of 1916 in cooperation with the Mississippi Experiment Station on the Canton Stock Farm, near Canton, Madison County, Mississippi.

The experiment had for its **chief object** a further study of the fattening of steers on summer pasture, emphasizing especially the comparison of pasture alone and pasture supplemented with cottonseed cake. The test was planned along the same lines as the previous ones.

The **stock used** in this test were inferior mature steers of nondescript breeding, weighing from 550 pounds to 1,000 pounds each when the experiment began. Evidences of Jersey breeding were most prominent, while a few showed marks of Shorthorn, Hereford, Aberdeen-Angus, Red Polled and Devon breeding. As a whole they were typical scrub steers of the South and very few were good feeders. All but 15, which were raised on the farm, had been bought in Madison County early in May. They were divided into 2 lots of 30 each, as equally as possible in regard to size, condition, and quality. Madison County is in tick-free territory, and as no ticks were on the animals dipping was unnecessary.

This region is in what is called the "brown-loam" classification, and the soil is very fertile, producing a great variety of grasses and clovers. The principal plants which furnished grazing were lespedeza, Paspalum, Bermuda grass, white clover, and some crab grass. No stock had been on the pastures before the experiment began, so that an abundance of grass and clover was available for the cattle throughout the experiment.

Heavy rains sometimes caused water to stand on parts of both pastures and the grass was considered too "washy" to produce the best gains on the cattle. Parts of the pastures were interchanged from one pasture to the other, so that discrepancies due to a difference in pastures might be avoided.

The steers in Lot 2 were fed their cake in troughs in the pasture about sundown each day. They came up well for their feed, and relished it. Water was obtained from ditches and pools in the pastures.

Lot 1 had only pasture. Cottonseed cake was fed to Lot 2 at the rate of 2 pounds a head daily for the first few days. This was increased gradually during the first 3 periods, until on August 1 the average daily allowance per head was 5 pounds, which quantity was fed until the steers were marketed.

Table 35—The Value of Cottonseed Cake When Used as a Supplement to Pasture for Fattening Steers in Clay and Madison Counties, Mississippi.
Average of 2 Trials 1915 and 1916.

	Lot 1 Pasture alone	Lot 2 Pasture and cottonseed cake
Number of steers	25	25
Av. length of feeding period	120	120
Av. initial weight per steer	670	671
Av. final weight per steer	867	906
Av. total gain per steer	197	235
Av. daily gain per steer	1.64	2.96
Av. daily ration per steer:		
Cottonseed cake		2.48

Note: The steers were taken off the experiment on September 28, driven to Canton on September 29, shipped to the St. Louis market, and slaughtered. After the steers had taken their "fill" at the market and were weighed, it was found that those of Lot 1 had lost an average of 57 pounds, while those of Lot 2 had lost 79 pounds. This wide variation in shrinkage between the 2 lots can not be accounted for. The conclusion that cake-fed steers shrink more in transit than grass-fed cattle is not supported by the results of many other shipments of steers.

Reference: United States Department of Agriculture Bulletin No. 777, pages 12, 13, 14, 16, 17, 18, "Fattening Steers on Summer Pasture in the South," July 10, 1919, Washington, D. C.

Suggestive: Did the addition of cottonseed cake increase the net profit per steer? (Calculate using present prices).

II

The Efficiency of Varying Amounts of Cottonseed Cake When Fed as a Supplement to a Full Corn and Silage Ration in Fattening Baby Beef at Manhattan, Kansas.

Cattle used—The calves used in this experiment were high-grade Herefords. They were raised at the Fort Hays branch of the Kansas Agricultural Experiment Station and were shipped to Manhattan, October 22, 1922. During the time which elapsed between this and November 3, when the experiment was started, the calves were fed on cane silage and alfalfa hay. The 50 steers were divided as carefully as possible with regard to size, type and quality into five lots. Ten heifers similar to the steers in size, type and quality were placed in the sixth lot.

Each group was kept in a lot approximately 30 by 40 feet, including a shed 15 feet deep and open on the south, located across the north end of the lot. They had access to salt and water at all times.

Method of Feeding—Each lot was fed exactly the same basal ration of shelled corn and cane silage, both full fed, and two pounds of alfalfa hay per head per day. In addition to this the different lots were fed cottonseed cake in the following amounts per head per day:

Lot 1. None.

Lot 2. One-half pound.

Lot 3. One pound.

Lot 4. One and one-half pounds.

Lot 5. Two pounds.

The heifers in Lot 6 were fed exactly the same as the steers in Lot 5.

Detailed results are given in Table 36.

Table 36—The Efficiency of Varying Amounts of Cottonseed Cake When Fed as a Supplement to a Full Corn and Silage Ration in Fattening Baby Beef at Manhattan, Kansas. 1922.
(Length of test 231 days).

	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	Lot 6
Av. initial wt., lbs.	355.42	344.80	342.67	339.48	349.00	357.37
Av. final wt., lbs.	780.00	803.00	819.00	816.67	837.78	828.00
Av. total gain, lbs.	424.58	458.20	476.33	477.19	488.78	470.63
Av. daily gain, lbs.	1.84	1.98	2.06	2.07	2.12	2.04
Av. daily ration, lbs.:						
Cottonseed cake		.50	.98	1.45	1.92	1.91
Shelled corn	9.71	9.71	9.71	9.69	9.71	9.66
Alfalfa hay	2.00	2.00	2.00	2.00	2.00	2.00
Cane silage	9.10	9.16	9.12	9.04	9.13	9.12
Feed required per 100 lb. gain, lbs.:						
Cottonseed cake		24.99	47.55	70.41	90.63	93.59
Shelled Corn	528.46	489.69	471.05	469.00	459.01	474.39
Alfalfa hay	108.81	100.83	96.99	96.82	94.48	98.00
Cane silage	494.90	461.92	442.06	437.83	431.62	447.44

Reference: Kansas Agricultural Experiment Station Contribution 71, page 23, Table I, "Silage Feeding Investigation," 1922-23, Manhattan, Kansas.

Suggestive: What was the average daily gain in Lot 5? In Lot 1? Which lot made the most economical gains?

III

The Value of Cottonseed Cake When Used as a Supplement to Pasture for Fattening Steers at Auburn, Alabama. 1910.

The object of this test was to determine the profits, if any, in supplementing sandy soil pasture with cottonseed cake during the summer fattening process.

The Cattle Used—The cattle used in this experiment represented no particular breeding. They were, in fact, scrubs or common cattle of the neighborhood. Their ages ranged from three to four years. They were all dehorned before the test began.

Pasture Used—Large areas of the pastures used were low so that in rainy weather they became exceedingly wet. There was some ridge land, however, in each pasture.

Carpet grass, lespedeza, broom sage and a small amount of Bermuda and paspalum constituted the grasses that formed the pastures. They afforded an abundance of grass throughout the grazing season but the growth was rank and very watery, as frequent rains kept the pasture exceedingly wet during the whole test.

The cottonseed cake used had been broken into nut-size by the oil mill and sacked.

Both lots of cattle had had the run of a large range of approximately 20,000 acres of land throughout the winter without any kind of feed, however, the steers had some grazing in frost killed grass the first part of the winter. During the latter part of the winter when grazing is unusually short, no little amount of Augusta vetch came up and furnished good grazing during the early spring months. This plant, more than anything else, kept the steers from losing weight. It gave good grazing until the steers were put on the summer pasture test April 23.

Two lots were used for this experiment. Lot X was on pasture, supplemented with cottonseed cake. Lot Y was on pasture alone.

Details of the experiment are given in the following table.

Table 37—The Value of Cottonseed Cake When Used as a Supplement to Pasture for Fattening Beef Steers at Auburn, Alabama. April 23 to September 2, 1910. Length of Test—133 Days.

Ration	Lot X Pasture and C. S. Cake	Lot Y Pasture Alone
No. of steers per lot	28	15
Av. initial weight, lbs.	572	580
Av. final weight, lbs.	761	757
Av. gain per steer, lbs.	189	177
Av. daily gain, lbs.	1.42	1.33
Av. daily ration, lbs.:		
Cottonseed cake	3.6	.....
Av. feed required per 100 lb. gain, lbs.:		
Cottonseed cake	274	.....

Reference: Alabama Agricultural Experiment Station Bulletin 163, pages 80, 81, 82 and 91, Tables XI and XII, "Steer Feeding in Alabama," December, 1911, Auburn, Alabama.

Suggestive: How much gain was made per steer in each lot? Did the feeding of cottonseed cake pay in this case?

IV

The Value of Cottonseed Cake When Used as a Supplement to Pasture for Fattening Steers in Sumter County, Alabama, 1912-13, Two Year Average. (The 1912 Test)

The object of the experiment was to determine whether it is profitable to feed cottonseed cake to cattle on pasture: The steers of the three lots were chiefly grade Herefords, Shorthorns and Aberdeen-Angus. A few were grade Red Polls. All were 2 and 3 year olds of fair quality. They were divided unequally in number purposely to conform to the size of pasture used.

The cottonseed cake used in this test was nut size and of good quality, containing about 38 per cent crude protein. The advantages of feeding cake instead of meal are these: Rains do not make the cake unpalatable and winds do not blow it out of the feed bunks; the cake requires chewing, and greedy steers can not eat more than their share at the expense of the timid ones. When cottonseed meal is fed in open pastures, rain and wind are liable to cause waste; greedy steers bolt it and often get scours, which causes the animal to feed out unevenly.

The summer pastures used in these experiments consisted of a mixture of sweet clover (*melilotus*), Japan clover (*lespedeza*), Johnson grass, crab grass, and some Bermuda grass. The sweet clover seed had been planted, but the other plants were purely voluntary. As a rule sweet clover becomes available for light grazing before May 15.

The steers were put on pasture May 28, 1912. The pastures had not been used for a month and were in fine condition.

Lot 1 was supplied with good artesian water, while Lot 3 had water only from pools in the pasture. All the cattle were salted once a week. The cattle of Lot 1 had little attention other than salting. Lot 3 was fed cottonseed cake in troughs placed in the pasture. The cattle went on feed well, and came up for their feed with little trouble. All steers were dipped four times during the progress of the experiment to insure freedom from ticks.

(The 1913 Test)

The experiment conducted during the summer pasture season of 1913 was essentially a duplicate of previous year's test. The steers used were mostly 3-year-olds, with a few 2-year-olds that had been wintered on the Cobb farm. All were in thrifty condition April 8, 1913, when initial weights were taken. Most of the cattle were grade Aberdeen-Angus, Herefords and Shorthorns, though a few showed Jersey blood. In general the steers were typical of those raised in Alabama at the time of the experiment.

The same pastures were used as in the 1912 experiment, but all of them furnished better grazing. The pasture of Lot 1 had more sweet clovers. The only water in the pasture of Lot 3 was that in ditches and pools; Lot 1 contained both well water and ditch water. Except for a short, dry period early in May, rains were quite frequent and the steers had an abundance of grass throughout the summer.

Each day, about sundown, the steers in Lot 3 were fed in troughs in the open pasture. All were dipped in arsenical dip five times during the experiment, to keep them free from ticks. Salt was provided once a week.

The steers had been fed cake lightly for about 5 weeks before the test. Lot 3 was given, therefore, 3 pounds of concentrates per head at the beginning, and the quantity was gradually increased until on May 10 the steers of Lot 3 were each eating 4 pounds of cottonseed cake daily. This quantity was fed daily until the end of the experiment, September 2.

Table 38—The Value of Cottonseed Meal When Used as a Supplement to Summer Pasture in Sumter County, Alabama. Average of Two Trials 1912 and 1913.

	Lot 1 Pasture Alone	Lot 3 Pasture and cottonseed cake
Number of steers	27	31
Average length of feeding period	129	124
Average initial weight per steer	628	602
*Average final weight per steer	806	821
Average total gain per steer	178	219
Average daily gain per steer	1.33	1.69
Average daily ration per steer:		
Cottonseed cake		3.63

*In 1912 the final weight was based on market weight. In 1913 the final weight was based on farm weight.

Note: The steers were sold to butchers at Meridian, Miss., about 50 miles from the farm. The dressing percentages show that the steers of Lot 3, which were fed cake dressed out approximately 3 per cent higher than those getting pasture only, which indicates the higher finish on the cake-fed steers.

Reference: United States Department of Agriculture Bulletin No. 777, pages 3, 4, 8, 9, 5, Tables 1, 4, "Fattening Steers on Summer Pasture in the South," July 10, 1919, Washington, D. C.

Suggestive: How much more did each steer gain in Lot 3 than in Lot 1? What was the difference in the cost of total gain per steer?

V

The Value of Cottonseed Cake When Used as Supplement to a Sudan Grass Pasture for Fattening Steers at Beeville, Texas.

The object of this test was to determine whether Sudan grass should be supplemented with cottonseed cake when grazed by yearling steers. Thirty-four good to choice Hereford steer calves were purchased in August, 1932, from Mr. Dick Scott, Beeville, Texas. These 416 pound calves were grazed on the Sudan fields from September 2, to November 28, 1932. Except for the first 28 days of this period, they were fed a small amount of supplementary feed. These calves were started in a winter fattening test but following a severe stomach worm infestation and the subsequent treatment, the test was abandoned February 3, 1933, and a maintenance ration fed until the beginning of the Sudan grazing test April 27. During the 237 days, September 2 to April 27, the calves were fed an average of 1.6 lbs. ground ear corn, and ground hegari heads mixed; 1.4 lbs. cottonseed meal and 8.2 lbs. roughage per head daily. They gained 186.4 lbs. per head and entered the grazing test averaging 652.4 lbs. Following the Sudan grazing period, they were finished in dry lot.

The steers which received cottonseed cake were fed nearly as much as they would eat. Beginning with 2 pounds per head daily, gradual increases were made to 6 pounds daily, the average daily consumption being 4.64 pounds for the 108 day period.

Details of the results obtained during this trial are given in the following table.

Table 39—The Value of Cottonseed Cake When Used as a Supplement to a Sudan Grass Pasture for Fattening Steers at Beeville, Texas. April 27 to August 13, 1933. (108 Days).

Ration	Sudan Alone Lot 1	Cake on Sudan Lot 2
No. of steers per lot	17	17
Av. initial wt., lbs.	654.2	650.6
Av. final wt., lbs.	801.9	843.7
Av. total gain per steer, lbs.	147.7	193.1
Av. daily gain, lbs.	1.37	1.79
Av. lbs. cake fed daily, lbs. ....	.....	4.64
Av. lbs. cake required per 100 lb. gain, lbs. ....	.....	260.0

Note: Scouring, loss in weight and other symptoms of parasitism were noted among these calves during the fall of 1932. The trouble was not definitely recognized until in February when post mortem examination of one calf revealed a heavy infestation of stomach worms. The calves, then averaging 550 pounds, were given 300 cc per head of 1.75% copper sulphate and .8% nicotine sulphate solu-

tion. This treatment was repeated two weeks later, but the calves were not treated again until they had completed the Sudan grazing period and were 800 to 850 pound yearlings. They were drenched three times at ten day intervals with 500 cc per head of the same solution. This treatment occurred during the preliminary feed lot period, August 14 to September 7. The parasite infestation handicapped these steers. The steers improved rapidly after the treatments in February. No stomach worms were found when the steers were slaughtered in December. In comparing the two groups when finished in dry lot, the steers which received cottonseed cake with Sudan grazing finished in 99 days as compared to 122 days for the steers on Sudan alone.

Reference: Texas Agricultural Experiment Station Cattle Feeding Report Series No. 15, pages 1, 2 and 3, Tables 2 and 3, July, 1934, Beeville, Texas.

Suggestive: Was the increase in total gain per steer sufficient to pay for the cottonseed cake? (Calculate additional feed-cost and value of extra beef, use current prices).

VI

The Value of Cottonseed Cake When Used to Finish Steers on Grass in Haywood County, North Carolina. 1914-1916.

The object of this experiment was to determine which was the most profitable plan, viz, to finish steers on grass alone or to finish them on grass and cottonseed cake.

The steers used in the experiment were mostly two year old grade Shorthorns, Herefords and Angus with a small amount of Devon blood.

The steers had been wintered on various rations consisting of

Lot 1. Ear corn, corn stover and hay.

Lot 3. Corn stover and corn silage.

Most of the pasture used had been established for some time; they consisted of a mixture of blue grass, clover, orchard grass, Timothy and Herd's grass. The land was rolling and hilly, some of it being very rough and steep, having some of the old dead trees standing.

The steers were turned on pasture in the spring as soon as the grass would carry them without injury to its subsequent growth. They were given salt once a week.

Troughs were provided in the pasture for feeding the cottonseed cake which was given late in the afternoon.

The steers were given an average of about 3 acres of pasture per steer during the summer.

The different lots were divided as nearly uniform in weight and quality as possible, and fed as follows:

Lot 1. Pasture and cottonseed cake.

Lot 3. Pasture only.

Details of this test are reported in the following table.

Table 40—The Value of Cottonseed Cake When Used as a Supplement to Grass Pasture for Finishing Beef Cattle in Haywood County, North Carolina, 1914-1916. A Three Year Average.

Ration	Lot 1 Pasture and C. S. Cake	Lot 3 Pasture Alone
Av. number of days on feed	133	152
Av. number steers per lot	16	33
Av. initial weight, lbs.	757	691
Av. final weight, lbs.	1103	1044
Av. gain per steer, lbs.	346	353*
Av. daily gain, lbs.	2.65	2.44
Av. daily ration of cottonseed cake, lbs.	3.80	.....
Av. lbs. cottonseed cake required per 100 lb. gain, lbs.	143.3	.....

*These steers were grazed 19 days longer than those in Lot 1.

Reference: U. S. D. A. Bulletin 628, pages 20, 21, 22, Tables IX and X, "Wintering and Fattening Beef Cattle in North Carolina," January, 1918, Washington, D. C.

Suggestive: What was the average daily gain per steer in Lot 1? In Lot 3? How much cottonseed cake was consumed per 100 lb. gain in Lot 1? Was the feeding of cottonseed cake in Lot 1 justified?

2—COTTONSEED CAKE VERSUS OTHER CONCENTRATES

I

Cottonseed Cake Versus Mixed Grains for Growing Beef Cattle at Laramie, Wyoming, 1914-15.

The object of this test was to make a comparison in the feeding value of cottonseed cake and mixed grains for growing beef cattle during the winter months.

Cattle Used—The cattle used in this experiment were Herefords kept in the college herds. Each of the two lots consisted of two Aberdeen-Angus and two Poll-Herefords. Lot 1 averaged 10 months and 8 days, in age while Lot 2 averaged 10 months and 29 days.

Feed Used—The corn used was native ground. The bran used was what is known as mill fed or mill run bran. No attempt had been made to separate the bran and middlings. The cottonseed cake used was 40 per cent protein. The hay used was made from native grasses.

The lots were fed the following ration:

Lot 1. Corn meal, bran and native hay.

Lot 2. Cottonseed cake and native hay.

Details of the experiment are given in the following table.

Table 41—Cottonseed Cake Versus Mixed Grains for Growing Beef Cattle at Laramie, Wyoming, Winter of 1914-15. Length of Test, 141 Days.

Ration	Lot 1 Corn meal and Bran	Lot 2 Cottonseed cake
No. of steers per lot	4	4
Av. initial weight, lbs.	562.5	531.3
Av. final weight, lbs.	697.3	628.3
Av. gain per steer, lbs.	134.8	97.
Av. daily gain, lbs.	.95	.68
Av. daily ration, lbs.:		
Corn meal	2.	.....
Bran	2.	.....
Cottonseed cake .....	.....	2.
Hay	9.1	9.2
Av. feed required per 100 lb. gain, lbs.:		
Corn meal	209.	.....
Bran	209.	.....
Cottonseed cake .....	.....	260.
Hay	896.	1269.

Reference: Wyoming Agricultural Experiment Station Bulletin 106, pages 7, 8, 9 and 10, Tables A, B, C and D, "Mixed Grain Versus Cottonseed Cake for Growing Beef Cattle," July, 1915, Laramie, Wyoming.

Suggestive: Compare the average gain per steer in the two lots. Which lot made the more economical gain? (Use current prices).

II

Cottonseed Cake Versus Grain as Supplemental Feeds for Calves and Yearlings at Hays, Kansas, 1931-1933.

The purpose of this test was to determine the possibility and advisability of substituting grain for cottonseed cake as supplements to such feeds as silage, fodder and sorghum hay when these feeds are used as the basis of stock cattle rations.

Each of the five lots in this experiment received Atlas sorgo silage as the basal ration. In addition Lot 1, the check group, received 1 pound cottonseed cake per head per day. Each of the other lots received 2 pounds of grain per head per day; Lot 2, ground kafir; Lot 3, ground milo; Lot 4, ground barley; and Lot 5, ground wheat.

During the winter of 1931-32 the experiment extended over a period of 150 days; during the winter of 1932-33, a period of 155 days. During the summer of 1932 the cattle in this test were grazed together at the Hays Branch Experiment Station.

The results of these two experiments conducted during the winters of 1931-32 and 1932-33 are given in detail in Table 42.

Table 42—Cottonseed Cake Versus Grain as Supplement to Atlas Sorgo Silage.

Lot No.	1	2	3	4	5
No. animals per lot	10	10	10	10	10
Ration fed	At. Sor. Silage C. S. Cake	At. Sor. Silage Ground Kafir	At. Sor. Silage Ground Milo	At. Sor. Silage Ground Barley	At. Sor. Silage Ground Wheat
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Av. wt. per hd., Nov. 21, 1931	430.80	429.70	430.20	430.40	428.00
Av. weight per head, April 19, 1932	559.50	549.70	547.80	563.30	558.00
Average gain per head winter, 1931-32	128.70	120.00	117.60	132.90	138.20
Average weight per head, Nov. 18, 1932	691.70	700.33	699.70	698.80	707.10
Average gain per head, summer 1932	132.20	150.63	152.00	137.50	139.10
Average weight per head, April 20, 1933	911.80	867.20	851.50	897.0	926.70
Average gain per head winter, 1932-33	220.10	166.87	151.80	189.90	219.60
Av. gain per head Nov. 21, 1931 to April 20, 1933	481.00	437.50	421.40	467.30	496.90
Av. daily ration fed:					
Atlas sorgo silage					
1931-32 as calves	31.00	31.00	31.00	31.00	31.00
1932-33 as yearlings	53.05	52.89	52.90	53.05	53.05
Supplement—same each year					
Cottonseed cake	1.60				
Ground kafir		2.00			
Ground milo			2.00		
Ground barley				2.00	
Ground wheat					2.00
Gain per ton of atlas sorgo sil. fed					
1931-32 as calves	55.18	51.45	50.42	56.98	59.25
1932-33 as yearlings	53.50	40.80	37.10	48.30	53.50

Reference: Kansas Agricultural Experiment Station Twenty-first Annual Cattlemen's Round-up, April 1933, pages 3, 4 and 5, Tables I and II.

Suggestive: What grain substituted gave a higher total gain than cottonseed cake? What were the relative profits according to present prices?

III

Cottonseed Cake Versus Cold Pressed Cottonseed Cake as a Protein Supplement for Stock Cattle at Hays, Kansas, 1925-1926.

The large number of inquiries relative to the value of cottonseed cake and cold pressed cottonseed cake, prompted no doubt by the fact that cold pressed cottonseed cake is cheaper than cottonseed cake, indicated the need of more information regarding the feeding value of these two feeds as protein supplements for stock cattle. To secure information bearing upon the problem two lots of calves—one heifers and one steers—were wintered on cane silage supplement with cottonseed cake and two lots—one heifers and one steers—were wintered on cane silage supplemented with cold pressed cottonseed cake. Details of the results secured are given in Table 43.

Table 43—Cottonseed Cake Versus Cold Pressed Cottonseed Cake as a Protein Supplement for Silage for Wintering Calves at Hays, Kansas. 1925-1926.

Ration	Lot 11* Cane silage C. S. cake	Lot 12* Cane silage Cold pressed C. S. cake	Lot 13** Cane silage C. S. cake	Lot 14** Cane silage Cold pressed C. S. cake
No. of days on test	130	130	130	130
Av. initial wt. per calf, lbs.	476.50	487.50	503.5	499.00
Av. final wt. per calf, lbs.	588.5	574.5	632.5	591.00
Av. gain per calf, lbs.	112.0	96.0	129.	92.00
Av. daily gain per calf, lbs.	.86	.74	.99	.71
Av. daily ration per calf, lbs.				
Cane silage	31.00	31.00	31.0	31.0
Cottonseed cake	1.50		1.5	
Cold pressed cottonseed cake		1.5		1.5
Feed required per 100 lb. gain, lbs.				
Cane silage	3604.68	4188.	3181.	4371.
Cottonseed cake	174.39		151.5	
Cold pressed cottonseed cake		206.6		211.5

*The calves in Lots 11 and 12 were heifers. **The calves in Lots 13 and 14 were steers.

It might be well to mention that the chief difference in the manufacture of these two protein concentrates lies in the fact that the hulls are removed and only the kernels pass through the press in making cottonseed cake, whereas, the whole seed is passed through the press in making cold pressed cottonseed cake. The cold pressed cottonseed cake contains a much higher percentage of hulls and less protein than the ordinary cottonseed cake.

Reference: Kansas Experiment Station Fourteenth Annual Cattlemen's Round Up, page 8, Table IV, May 1, 1926, Hays, Kansas.

Suggestive: How much gain did the heifers in Lot 11 make? How much in Lot 12? To what can this difference be attributed? Does the test with steers in Lot 13 and 14 prove the same point as the test with the heifers in Lot 11 and 12? What is the difference between cottonseed cake and cold pressed cottonseed cake?

IV

Cottonseed Cake Versus Linseed Oil Cake for Fattening Calves at Fort Collins, Colorado, 1931-32.

One of the objects of this experiment was to determine the relative feeding value of cottonseed cake and linseed oil cake in a beet by-product ration.

The Cattle Used: Eighty choice-quality grade Hereford steer calves were bought in the vicinity of the station and used in the test. They averaged about 420 pounds at the start. These calves were divided into eight as nearly uniform lots as possible by balancing the factors of weight, origin, type, breeding, condition and color. Only the first four lots are considered here.

The following rations were fed the steers:

Lot 1. Ground corn, ground barley, .5 pound cottonseed cake, wet beet pulp, alfalfa hay.

Lot 2. Ground corn, ground barley, 1 pound cottonseed cake, wet beet pulp, alfalfa hay.

Lot 3. Ground corn, ground barley, 1.5 pounds cottonseed cake, wet beet pulp, alfalfa hay.

Lot 4. Ground corn, ground barley, 1 pound linseed oil cake, wet beet pulp, alfalfa hay.

The grain-and-cake ration was fed twice daily, morning and evening. Pulp was hauled into the cattle pens shortly after the morning grain feed. Alfalfa, mineral mixture and salt were self-fed. The cattle were started on 1 pound of grain concentrate per head daily and gradually increased to 8 pounds daily. Cake was fed at the rate of .1 pound per head at first but increased quite rapidly to the specified amount in the ration. Wet pulp was fed as heavily as the calves would consume it and until 35 pounds per head per day was reached.

Table 44—Cottonseed Cake in Various Amounts and in Comparison to Linseed Oil Cake at Fort Collins, Colorado, 1931-32.
Fed 194 days. November 18, 1931 to May 30, 1932.
Alfalfa, minerals and salt self-fed in all lots.

Lot No.	I	II	III	IV
	.5 lb. C. S. Cake	1 lb. C. S. Cake	1.5 lb. C. S. Cake	1 lb. L. O. Cake
Animals per lot	10	10	10	10
Weight at start, lbs.	423.0	422.5	427.3	420.7
Market weight at Denver, lbs.	806.5	813.0	816.0	803.9
Gain at market, wt. lbs.	383.5	390.5	388.7	383.2
Daily gain at market, wt. lbs.	1.98	2.01	2.00	1.97
Shipping shrinkage (percentage)	4.56	3.90	4.39	4.17
Average daily feed (lbs.)				
Ground corn	2.46	2.46	2.46	2.46
Ground barley	2.46	2.46	2.46	2.46
Cottonseed cake	.49	.98	1.45	.....
Linseed oil cake .....	.....	.....	.....	.98
Wet beet pulp	25.65	25.49	25.50	25.31
Alfalfa hay	6.97	6.67	6.50	6.09
Mineral mixture	.02	.02	.02	.02
Salt	.03	.03	.03	.03
Feed required per cwt. market gain (lbs.)				
Ground corn	124.5	122.4	123.0	124.7
Ground barley	124.5	122.4	123.0	124.7
Cottonseed cake	25.0	48.8	72.6	.....
Linseed oil cake .....	.....	.....	.....	49.7
Wet beet pulp	1297.8	1266.4	1272.8	1281.8
Alfalfa hay	352.8	331.4	324.4	308.6
Mineral mixture	1.2	.8	.8	1.0
Salt	1.6	1.6	1.7	1.4

Note: The selling price was the same for both cottonseed and linseed oil cake lots and a carcass study in the packing house coolers showed six good and four medium carcasses where cottonseed cake was fed and only two good and seven medium carcasses in the lot fed linseed oil cake as the protein supplement.

Reference: Colorado Agricultural Experiment Station Press Bulletin 78, pages 2, 3 and 4, Table I, "Progress Report of Livestock Feeding Experiment 1932," September 1932, Fort Collins, Colorado.

Suggestive: What amount of Cottonseed Meal gave the greatest gain? How does this compare with Linseed Meal? Which ration required the least amount of feed per cwt gain? Does this ration give the most economical gain? (Use current prices).

3—THE ADDITION OF COTTONSEED CAKE TO RATIONS

I

The Value of Cottonseed Cake When Added to a Ration of Ground Barley, Sunflower Silage and Alfalfa for Fattening Beef Yearlings at Fort Collins, Colorado, 1922-24.

The experimental cattle feeding pens of the Colorado Experiment Station are located on the college farm. The pens are 114 by 24 feet in size, the long dimension running north and south. At the north end of the lots, 14 by 24 foot sheds provide shelter for the cattle. Water is piped into each lot. Small galvanized watering troughs were used. No cover was provided for the hay.

In 1922 the south end of the pens around the hay bunks, and also around the grain troughs, was cemented and the rest of the yard graveled to get away from the mud and mire present.

The quality of steers and heifers used in these experiments has perhaps been somewhat above the average grade of cattle fed in most commercial feed lots.

Experiment 1922-23.

Sixty-six good grade Hereford steers were purchased in May, 1922. They were put on the college foothill range May 19, weighing 435 pounds per head. On October 17 they were taken off the range, weighing 688 pounds. They were carried on beet tops and beet-top silage until November 25, when they were divided into six equal pens of 10 steers each and started on the fattening test.

All feeds were fed twice daily. Alfalfa hay was fed three times daily.

The feeds used in this test were as follows:

Barley was locally grown, good quality grain.

Cottonseed cake was guaranteed 43 per cent protein.

Sunflower silage was made from sunflowers yielding 17.2 tons per acre. The plants had developed branching heads when cut for silage. This silage was from plants too mature and very unpalatable to the cattle.

Alfalfa hay was of good quality.

Experiment 1923-24.

The grade Hereford steers used in this test were purchased as yearlings in May, 1923. They were put on the college foothill range weighing 447 pounds per head. On October 29 they were taken off the range weighing 687 pounds and were fed silage and alfalfa until December 12, when they were divided into six equal pens of 10 steers each and started on the fattening test. At that time they weighed an average of 759 pounds per head. They were graded good.

All feeds were fed twice daily, morning and evening. Alfalfa was fed so that the steers had access to it at all times. The feeds used in this test were:

Barley was locally grown California feed barley.

Cottonseed cake was guaranteed 43 per cent protein.

Sunflower silage was made from sunflowers yielding 19.2 tons per acre. They were cut at an immature stage when only about one third of the heads were in bloom. This was much more palatable and a brighter silage than that of the previous year.

Alfalfa hay was of good quality.

Table 45—The Value of Cottonseed Cake When Added to a Ration of Ground Barley, Sunflower Silage and Alfalfa for Fattening Yearling Steers at Fort Collins, Colorado. 2 Year Average (183 days) 1922-23, 1923-24.

Ration fed	Lot 1	Lot 2
	Ground barley Sunflower silage Alfalfa	Cottonseed cake Ground barley Sunflower silage Alfalfa
No. of steers per lot	10	10
Average initial weight, lbs.	738.2	735.1
Average final feed lot weight, lbs.	1125.8	1139.2
Average gain steer, lbs.	387.6	404.1
Average daily gain per steer, lbs.	2.12	2.21
Average daily ration fed, lbs.:		
Ground barley	11.31	11.14
Cottonseed cake .....	.....	1.85
Sunflower silage	17.83	16.83
Alfalfa	9.69	7.84
Feed required per 100 lb. gain at feed lot, lbs.:		
Ground barley	533.4	504.7
Cottonseed cake .....	.....	83.6
Sunflower silage	842.7	762.9
Alfalfa	456.7	355.1

Note: The carcass grade was the same in each lot.

Reference: Colorado Experiment Station Bulletin 422, pages 67, 79, 80, 81 and 85, Table 42, "Colorado Fattening Rations for Cattle," February, 1936, Fort Collins, Colorado.

Suggestive: What was the average gain per steer in each lot? To what do you attribute the difference? Based on total gain, was the feeding of cottonseed cake justified?

II

Feeding Cottonseed Cake in Varying Amounts When Silage is Used as the Basal Winter Ration for Stock Cattle, Hays, Kansas, 1933-34.

Object—Six lots of calves were fed 150 days during the winter of 1933-34 in an effort to secure information as to the amount of cottonseed cake that should be fed to stock cattle with silage as the basal ration. To secure such information six lots of cattle were fed as follows:

Lot 4 All the silage the calves would eat. No protein supplement during the entire period of the experiment—150 days.

Lot 6 All the silage the calves would eat plus 1 pound of cottonseed per head daily during the entire period of the experiment—150 days.

Lot 7 All the silage the calves would eat. No protein supplement the first 60 days; one-half pound of cottonseed cake per head daily during the remaining 90 days.

Lot 8 All the silage the calves would eat. No protein supplement the first 60 days; one pound of cottonseed cake per head daily during the remaining 90 days.

Lot 10 All the silage the calves would eat plus one-half pound of cottonseed cake per head daily during the entire period of the experiment—150 days.

Lot 11 All the silage the calves would eat plus one-half pound of cottonseed cake per head daily the first 60 days; one pound per head daily the remaining 90 days.

The results of this experiment are given in Table 46.

III

Table 46—How Much Cottonseed Cake Should be Fed When Silage is Used as the Basal Winter Ration for Stock Cattle.

Lot No.	4	6	7	8	10	11
No. animals per lot	10	9	10	10	10	10
No. days on test	150	150	150	150	150	150
Daily Rations Fed	No cottonseed cake	One pound cottonseed cake	No cottonseed cake first 60 days then ½ lb.	No cottonseed cake first 60 days then 1 lb.	½ lb. cottonseed cake	½ lb. cottonseed cake first 60 days then 1 lb.
	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
Average weight per head into test Nov. 18, 1933.....	526.60	522.44	526.80	527.50	526.80	527.00
Average weight per head out of test April 17, 1934.....	632.80	712.55	675.30	705.80	698.00	717.70
Average total gain per head during test	106.20	190.11	148.50	178.30	171.20	190.70
Average daily gain per head during test	.71	1.27	.99	1.19	1.14	1.27
Average daily ration per head:						
Atlas sorgo silage	32.97	34.60	34.22	34.22	34.60	34.22
Cottonseed cake						
Entire period		1.00			.50	
First 60 days						.50
Last 90 days			.50	1.00		1.00
Total feed consumed per head:						
Atlas sorgo silage	4945.00	5190.00	5132.50	5132.50	5190.00	5132.50
Cottonseed cake		150.00	45.00	90.00	75.00	120.00

Reference: Kansas Agricultural Experiment Station Twenty-second Annual Cattlemen's Round-up, pages 6 and 7, Table III, April 28, 1934, Hays, Kansas.

Suggestive: Which lot made the greatest total gain? How much cottonseed cake was saved in Lot 11 over Lot 6? Which ration would you feed to obtain the greatest per cent return from money invested in feed?

4—COTTONSEED CAKE VERSUS ROUGHAGE

I

Cottonseed Cake Compared With Alfalfa and Corn Fodder for Wintering Beef Cows for Calf Production at Bozeman, Montana. 1926-1927.

The objects of this test were to compare cottonseed cake with alfalfa hay when fed with straw with a brush arbor as the only means of shelter, and to compare cottonseed cake with corn fodder when fed with straw when the cows are given good shelter.

The cattle used in this test were grade Herefords. The shed used was 19x150 feet and was divided into three equal size pens. A creek bottom with brush shelter was divided into equal size lots, ranging from 13 to 19 acres in area. There was a small amount of browse in these lots but as they had been overgrazed throughout the summer and fall the amount of feed available after the cattle were put in winter quarters was negligible. No sheds were provided for these lots.

The cows were kept on native grass during most of the grazing season. The lots were fed twice daily. The lots receiving silage or fodder, were fed the silage or fodder in the morning. Straw was given in the afternoon. The amounts of feeds were varied somewhat at the beginning of the trial and with changes of weather conditions. Salt was provided for all lots.

The feeds used: First cutting alfalfa hay, Northwestern Dent corn fodder containing very little corn, wheat straw of good quality and cottonseed cake, nut size, containing 43% protein.

The weather during this trial was unusually severe. The winter was considered hard on all classes of live stock in northern Montana. The snow covered the ground during the time of this test.

At the beginning of the trial the cows were carefully separated into lots as uniform as possible, with respect to weight, type, quality and condition and fed the following ration:

- Lot 1. Cottonseed cake and straw.
- Lot 2. Alfalfa hay and straw.
- Lot 3. Corn fodder and straw under shelter.
- Lot 5. Cottonseed cake and straw under shelter.

Table 47—Cottonseed Cake Versus Alfalfa Hay With Brush Arbor as Shelter and Cottonseed Cake Versus Corn Fodder With Shed as Shelter for Wintering Beef Cows for Calf Production at Bozeman, Montana. December 9, 1926 to March 21, 1927. (102 days).

Ration	Brush Arbor For Shelter		Shed For Shelter	
	Lot 1 C. S. cake and straw	Lot 2 Alfalfa hay and straw	Lot 3 Corn fodder and straw	Lot 5 C. S. cake and straw
No. of cows per lot	8*	10	9*	9*
Av. initial wt. lbs.	1021.9	1028.3	1028.7	1044.4
Av. final wt., lbs.	1016.5	1025.1	1023.7	1028.4
Av. gain or loss per head, lbs.	-5.4	-3.2	-5.0	-16.0
Av. daily ration, lbs.:				
Cottonseed cake	.95	.....	.....	.95
Straw	13.99	11.28	14.36	15.27
Alfalfa .....	.....	4.43	.....	.....
Corn fodder .....	.....	.....	5.68	.....
No. calves dropped during spring of 1927..	8	10	6	9

*Original No. 10 head. Removed from lots and feed deducted.

Reference: Montana Agricultural Experiment Station Bulletin 275, pages 23, 24, 27 and 28, Table XX, "Maintenance of Beef Cows for Calf Production," April, 1933, Bozeman, Montana.

Suggestive: Which of the rations maintained the weight of the cows through the winter best? Which lot dropped the most calves? Can all of these feeds be grown in your locality? Is the experiment of long enough duration to draw definite conclusions in regard to calf production?

SECTION C—WHOLE COTTONSEED AS A FEED

1—COTTONSEED VERSUS COTTONSEED MEAL

I

Cottonseed Versus Cottonseed Meal as a Supplement of a Kafir Corn Ration for Fattening Beef Steers at Clarendon, Texas. 1907.

The purpose of this test was to obtain data on a relative feeding value of cottonseed and cottonseed meal when used as a supplement for fattening beef steers.

Cattle Used—Most of the steers used in this test were well graded Shorthorns though there were a number of Herefords and a few cross breeds; they were considered above the average in conformation and quality.

Feeds Used and Method of Feeding—Throughout the test the roughage consisted of threshed Kafir corn stalks and bundled fodder which was fed in grain bunks.

On January 5, the day the experiment begun, Lot 1 was receiving 21 pounds Kafir corn meal per head daily and 4 pounds of cottonseed, while the ration for Lot 2 was 21 pounds Kafir corn and 4 pounds cottonseed meal per head. Between January 8 and 12, Lot 1 was carrying up to 5 pounds cottonseed. The corn remained the same. At the same time Lot 2 was raised to 22 pounds Kafir corn meal and the cottonseed meal reduced to 3 pounds per head. These amounts remained unchanged through March 7. On this date, the feed of both lots was increased as it was expected they would be marketed at the end of the month. All changes were made very gradually.

The steers were divided into uniform lots with special regard to weight, conformation, quality and age, and fed the following ration:

Lot 1. Ground Kafir corn, cottonseed and Kafir corn stover.

Lot 2. Ground Kafir corn, cottonseed meal and Kafir corn stover.

Details of the experiment are given in the following table.

Table 48—Cottonseed Versus Cottonseed Meal as a Supplement of a Kafir Corn Ration for Fattening Beef Steers at Clarendon, Texas. 1912. January 5 to March 30, 1912. Length of Test—84 Days.

Ration	Lot 1 Cottonseed	Lot 2 Cottonseed meal
No. of steers per lot	50	50
Av. initial weight, lbs.	1114.5	1114.5
Av. final weight, lbs.	1376.1	1317.6
Av. gain per steer, lbs.	261.6	203.1
Av. daily gain, lbs.	3.1	2.4
Av. daily ration, lbs.		
Kafir corn	21.5	22.6
Cottonseed	5.19	—
Cottonseed meal	—	3.3
Av. feed required per 100 lb. gain, lbs.		
Kafir corn	694.3	942.3
Cottonseed	167.12	—
Cottonseed meal	—	137.3

Note: The steers in Lot 1 fed cottonseed dressed 60 per cent, while those in Lot 2 fed cottonseed meal dressed 62 per cent.

Reference: Texas Agricultural Experiment Station Bulletin 97, pages 10, 11, 12 and 13, Table IV, "Kafir Corn and Milo Maize for Fattening Cattle," June, 1907, College Station, Texas.

Suggestive: How much gain was made per steer in Lot 1? In Lot 2? Which proved the more efficient as a supplement to Kafir corn, cottonseed or cottonseed meal?

II

Whole Cottonseed Versus Cottonseed Meal When Fed With Ground Milo Heads, Chopped Sumac Fodder and Pulverized Oyster Shells at Spur, Texas, 1932-1933.

This experiment was conducted at Substation 7, Spur, Texas, by the Texas Agricultural Experiment Station in cooperation with the Bureau of Animal Industry, U. S. Department of Agriculture.

Cattle Used: The steers available for this test were selected as an average of Herefords produced on ranches in Northwest Texas. The steers were divided as nearly equal as possible with respect to type, breeding and condition into lots of ten head each, and placed on feed November 16, 1932.

Table 49—Whole Cottonseed Versus Cottonseed Meal for Fattening Steers, Spur, Texas, (168 day test). Nov. 16, 1932 to May 3, 1933.

	Lot 1 Ground Milo hds. Cot- tonseed meal gr red top fodder	Lot 4 Ground Milo hds. Cot- tonseed meal gr red top fodder
Av. steers per lot	10	9
Av. initial wt. at feed lot, lbs.	689.43	699.20
Av. final wt. at feed lot, lbs.	1011.43	1007.78
Av. daily ration (amt. fed), lbs.:		
Grain	14.03	13.88
Cottonseed meal	2.67	.....
Cottonseed .....	.....	3.91
Roughage	8.34	6.98
Oyster shell, pulv.	.12	.12
Salt	.024	.025
Feed per 100 lb. gain (feed lot basis):		
Grain	731.83	755.73
Cottonseed meal	139.05	.....
Cottonseed .....	.....	212.91
Roughage	435.25	380.29
Total feed per steer (amt. fed) lbs.:		
Grain	2356.5	2332.02
Cottonseed meal	447.75	.....
Cottonseed .....	.....	657.0
Roughage	1401.5	1173.5
Oyster shell, pulv.	20.4	20.4
Salt	4.11	4.26
Carcass grades: Choice		
Good	1	1
Medium to good	8	4
Medium .....	.....	4
Fair	1	.....

Note: Comparing the two which received 2.67 lbs. cottonseed meal and 3.91 lbs. whole cotton seed respectively in the ration, it is observed that based on market weights, the average daily gains were practically the same. Based on final

feed lot weights, the dressed yield was 57.2% for the Lot 1 steers receiving cottonseed meal, as compared with 58.5% for the Lot 4 steers which received cottonseed in place of the meal. The Lot 4 ration containing the cottonseed seemed to be slightly less palatable than was the Lot 1 ration. In the previous year's test, there was little or no apparent difference in this respect.

Reference: Texas Agricultural Experiment Station, Substation 7, Spur, Texas. "Cattle Feeding Report," Series 8, June 23, 1933.

Suggestive: Does this experiment indicate that it is practical to feed whole cottonseed to steers?

III

Cottonseed Versus Cottonseed Meal for Fattening Yearling Steers on a Ground Threshed Milo and Alfalfa Hay Ration at Balmorhea, Texas, 1933-34.

Object—This is the third of a series of cattle feeding tests begun at the Balmorhea Substation in the Madera Valley three years ago, to determine the best methods of utilizing the locally grown feeds in cattle fattening rations. The object of the test was to determine the most economical ration for fattening yearling steers in that area.

The basal ration was composed of ground threshed milo, ground pegari fodder, alfalfa hay and salt. Lot 1 received cottonseed meal while Lot 5 received cottonseed.

Cattle Used—Good to choice Hereford yearling steers produced by the Reynolds Cattle Company near Kent were used in this test.

**Table 50—Cottonseed Fed Whole Versus Cottonseed Meal for Fattening Yearling Steers on a Ground Milo and Alfalfa Hay Ration at Balmorhea, Texas.
Dec. 20, 1933 to May 23, 1934.**

	Lot 1 C. S. Meal	Lot 5 Cottonseed
No. of steers per lot.....	10	10
Av. initial wt. at feed lot, lbs.....	677.75	675.27
Av. final wt. at feed lot, lbs.....	999.00	1051.57
Av. gain per head, feed lot wts., lbs.....	321.25	376.30
Av. daily gain, feed lot wts. lbs.....	2.09	2.44
Shrinkage per head during shipment, %.....	4.96	5.76
Feed consumed per 100 lb. gain, feed lot wts., lbs.:		
Ground threshed milo	410.	295.
Cottonseed	-----	136
Cottonseed meal	79	-----
Ground hegari fodder	374	334
Alfalfa hay	164	145
Total feed consumed per steer, lbs.:		
Ground threshed milo	1318	1110
Cottonseed	-----	510
Cottonseed meal	254	-----
Ground hegari fodder	1203	1255
Alfalfa hay	526	545
Salt	5.26	4.15
Carcass grades:		
Choice (Armour's 302 grade)	-----	1
Choice (Armour's 303 grade)	4	5
Good (Armour's 304 grade)	3	4
Medium (Armour's 34 grade)	3	-----

Note: Lot 1 made gains quite comparable with those of Lot 5 during the first 140 days, however, their appetites slackened and they had a small loss in weight in the final 14-day period.

Reference: Texas Agricultural Experiment Station Cattle Feeding Report, Series No. 19, pages 1, 2 and 3, Table 1 and 2, July 1934, Balmorhea, Texas.

Suggestive: Compare average gains in each lot and calculate the cost per pound of gain in each case. Which made the more economical gain, cottonseed or cottonseed meal?

2—THE VALUE OF COTTONSEED IN VARIOUS RATIIONS.

I

Cottonseed as a Protein Supplement to Grain Sorghum and Carbonaceous Hay for Fattening Yearling Steers, College Station, Texas, 1932-33.

This experiment was conducted by the Animal Husbandry Department, Texas A & M College, in cooperation with the Texas Agricultural Experiment Station; the Extension Service, Texas A & M College; and the Bureau of Animal Industry U. S. Department of Agriculture. The purpose of the test was to determine the value of cottonseed as a protein supplement in cattle feeding when used in varying amounts and to compare cottonseed meal and cottonseed when combined as a protein supplement with each feed when fed alone.

Cattle Used: Fifty short yearling Brazos County Steers, bred and raised on one ranch were used. They were light weight, thin cattle of fair to medium grade. They were dehorned.

The following rations were fed:

Lot 1. Ground threshed milo; cottonseed meal; Johnson grass hay.

Lot 2. Ground threshed milo; cottonseed in such amount as to make the protein content of the ration the same as Lot 1; Johnson grass hay.

Lot 3. Ground threshed milo; cottonseed (smaller amount than Lot 2); Johnson grass hay.

Lot 4. Ground threshed milo; same amount of cottonseed at Lot 3, with enough cottonseed meal added to bring the protein content up to that of Lot 1; Johnson grass hay.

Table 51—Cottonseed Fed in Varying Amounts and Compared With Cottonseed Meal, College Station, Texas, 1932-33. (158-Day Test).

	Lot 1	Lot 2	Lot 3	Lot 4
	Ground threshed milo C. S. Meal J. G. Hay	Ground threshed milo Cottonseed J. G. Hay	Ground threshed milo Cottonseed J.G. Hay	Ground threshed milo C. S. Meal Cottonseed J. G. Hay
No. steers per lot	10	10	10	10
Average initial wt. at feed lot, lbs.	490	486	487	486
Average final wt. at feed lot, lbs.	791	771	792	800
Average gain per head, feed lot wt., lbs.	301	285	305	323
Average daily gain per head feed lot wt., lbs.	1.90	1.80	1.93	2.04
Shrinkage per head during shipment, (Percentage)	5.44	4.93	5.43	5.44
Average daily ration (consumed) lbs.:				
Ground threshed milo	11.27	9.10	10.21	9.79
Cottonseed meal	1.72			.53
Cottonseed		3.63	2.89	2.88
Johnson grass hay	6.24	4.71	6.05	5.08
Limestone flour	.1	.1	.1	.1
Feed consumed per 100 lb. gain, feed lot wts., lbs.:				
Ground threshed milo	592	504	529	479
Cottonseed meal	90			26
Cottonseed		201	150	141
Johnson grass hay	328	261	313	248
Limestone flour	5.25	5.54	5.18	4.89
Total feed fed per steer, lbs.:				
Ground threshed milo	1781	1437.5	1612.6	1546.5
Cottonseed meal	271.6			83.2
Cottonseed		573.1	456.2	455.1
Johnson grass hay	1054.5	918.5	1024.	851.5
Limestone flour	15.8	15.8	15.8	15.8
Carcass grades: Good minus		2	1	
Medium plus	1	2	3	3
Medium	4	2	3	4
Medium minus	1	4	2	3
Common plus	3			
Common	1		1	

Note: There was little significant difference between the lots as regards dressing per cent and grade of carcass. The average grade of carcass in Lot 1 was a little lower than in the other three lots.

Reference: Texas Agricultural Experiment Station Cattle Feeding Report, Series No. 11, pages 1, 2 and 3, Table I and II, College Station, Texas.

Suggestive: What was the gain in Lot 1? In Lot 3? What difference is there in the ration of Lots 1 and 2? Is there any advantage in feeding whole cottonseed?

II

The Value of Cottonseed in a Ration of Limited Allowance of Concentrates for Finishing Yearling Steers, Balmorhea, Texas, 1932.

The object of the test was to determine economy of gains and finish of yearling steers as follows:

1. When full fed on a ration high in grain content.
2. When fed a limited allowance of grain.
3. When fed a limited allowance of concentrates in a ration in which whole cottonseed has replaced a portion of the grain.

Cattle Used—Thirty head of medium to good grade Hereford yearling steers raised by Mrs. J. L. Moore & Sons, Balmorhea, Texas, were used in this test. The lots were fed as follows:

Lot 1. Ground threshed milo (full fed); cottonseed meal; and ground hegari fodder 2 parts, and low grade alfalfa hay 1 part.

Lot 2. Ground threshed milo (grain limited); cottonseed meal; and ground hegari fodder 2 parts, and low grade alfalfa hay 1 part.

Lot 3. Whole cottonseed 1 part, ground threshed milo 2 parts (these concentrates limited to amounts fed Lot 2); cottonseed meal; and ground hegari fodder 2 parts, low grade alfalfa hay 1 part.

Lots 2 and 3 were supplied with as much roughage as they would consume.

Table 52—The Value of Cottonseed in a Ration of Limited Allowance of Concentrates for Finishing Yearling Steers, Balmorhea, Texas, (a 140 Day Test).

Lot	Lot 1	Lot 2	Lot 3
	Gr. Thr'd milo C. S. Meal Gr. hegari fodder Alfalfa hay Salt	Gr. Thr'd milo C. S. Meal Gr. hegari fodder Alfalfa hay Salt	Gr. Thr'd milo C. seed C. S. Meal Gr. hegari fodder Alfalfa hay Salt
No. of steers	8	8	10
Av. initial wt. at feed lot, lbs.	619.06	583.31	589.41
Av. final wt. at feed lot, lbs.	956.72	884.31	923.08
Av. gain per head, feed lot wts., lbs.	337.66	301.00	333.67
Av. daily gain per head feed lot wts., lbs.	2.41	2.15	2.38
Shrinkage per head during shipment to mkt.	5.80	5.15	5.59
Average daily ration, lbs.			
Ground threshed milo	10.08	6.67	4.45
Cottonseed			2.22
Cottonseed meal	1.87	1.87	1.87
Ground hegari fodder	5.42	7.46	7.84
Alfalfa hay	2.72	3.73	3.92
Salt	0.015	0.022	0.021
Feed required per 100 lb. gain, feed lot basis, lbs.:			
Ground threshed milo	418.02	310.22	186.61
Cottonseed			93.30
Cottonseed meal	77.59	87.04	78.52
Ground hegari fodder	224.68	347.15	328.97
Alfalfa hay	112.64	173.57	164.48
Salt	.62	1.05	.89
Total feed consumed per steer, lbs.:			
Ground threshed milo	1411.50	933.75	622.67
Cottonseed			311.33
Cottonseed meal	262.00	262.00	262.00
Ground hegari fodder	758.67	1044.92	1097.67
Ground alfalfa hay	380.33	522.46	548.83
Salt	2.08	3.15	2.98
Dressing percentage	61.27	60.33	61.11

Note: The addition of cottonseed to the ration in Lot 3 produced daily gains practically equal to Lot 1. There was no difference in finish as indicated by carcass grades although the Lot 1 steers on foot showed slightly more finish and sold at \$5.69 per 100 pounds as compared to \$5.46 for Lot 3. The cattle in the cottonseed lot showed more bloom than in either of the other two lots.

Reference: Texas Agricultural Experiment Station Cattle Feeding Series No. 6, pages 1, 2 and 3, Table I and II, 1932, Balmorhea, Texas.

Suggestive: From the results of this test, is it possible for cottonseed to be marketed profitably through steers?

SECTION D—COTTONSEED HULLS AS A ROUGHAGE

1—COTTONSEED HULLS VERSUS SILAGE

I

Cottonseed Hulls Versus Various Kinds of Silage for Feeding Beef Cattle at State College, Mississippi, 1914-1915.

The cattle used were a fairly uniform bunch of native Southern steers slightly above the average in quality; they were bought locally. All steers were dehorned just before going on feed. The steers were fed all winter in a shed open on three sides and shielded by a five foot wall on the north side.

Table 53—Cottonseed Hulls Versus Various Kinds of Silage for Feeding Beef Cattle at State College, Mississippi, 1914-15.

	Lot I	Lot II	Lot III Equal Parts Mixture Cowpea & Johnson Grass Silage	Lot IV Goliad Corn Stover Silage	Lot V Cotton- seed Hulls
Av. initial weight (lbs.)	887.8	902.8	809.06	941.25	809.06
Av. total gain per steer (lbs.)	243.8	216.8	179.8	71.4	216.8
Av. daily gain per steer (lbs.)	1.78	1.58	1.31	.65	1.58
Av. daily ration:					
Cottonseed meal (lbs.)	6.5	6.5	6.5	6.5	6.5
Silage or Hulls (lbs.)	45.32	45.32	45.32	45.32	27.15
Feed consumed per 100 lbs. gain:					
Cottonseed meal	365	410	495	997	410
Silage	2588	2910	3509	7070	1716

Reference: Mississippi Agricultural Experiment Station Bulletin 182, pages 5, 6 and 7, Tables II and III, "Silage for Fattening Steers," June 1917. State College, Mississippi.

Suggestive: Which of the silages gave a higher average daily gain than cottonseed hulls? Using current prices, which produces more economical gains, sorghum silage or cottonseed hulls?

II

Cottonseed Hulls Compared With Corn Silage, Sorghum Silage and Sagrain Silage for Finishing Beef Steers at State College, Mississippi. 1927-28.

The object of this test was to secure data on the feeding value of locally grown roughages for finishing beef steers.

The cattle used in this test were 2 and 3 year old native "Yellow Hammer" steers of fairly uniform type and quality. The roughages compared in this test were corn, Texas Seeded Ribbon Cane, sagrain silage and cottonseed hulls. The silages were produced on the Station farm. All the lots were fed the same amounts of cottonseed meal and Johnson grass hay, the steers were fed all the silage and cottonseed hulls that they would clean up twice daily. Fresh water and block salt were available at all times.

The rations fed:

Lot 1. Cottonseed meal, Johnson grass hay, corn silage.

Lot 2. Cottonseed meal, Johnson grass hay, cottonseed hulls.

Lot 4. Cottonseed meal, Johnson grass hay, sorghum silage.

Lot 5. Cottonseed meal, Johnson grass hay, sagrain silage.

Details of the experiment are reported in the following table.

Table 54—Cottonseed Hulls Compared With Corn Silage, Sorghum Silage and Sagrain Silage for Finishing Beef Steers at State College, Mississippi.
December 8, 1927 to April 6, 1928. (120 Days).

Ration	Lot 1 Corn Silage	Lot 2 C. S. Hulls	Lot 4 Sorghum Silage	Lot 5 Sagrain Silage
No. of steers per lot.....	8	8	8	8
Av. initial wt., lbs.....	728.7	727.7	727.6	726.8
Av. final wt., lbs.....	962.7	965.6	952.0	936.2
Av. gain per steer, lbs.....	234.0	237.9	224.4	209.4
Av. daily gain per steer, lbs.....	1.95	1.98	1.87	1.74
Av. daily ration consumed, lbs.				
Cottonseed meal.....	6.55	6.55	6.55	6.55
Johnson grass hay.....	3.0	3.0	3.0	3.0
Corn silage.....	43.35			
Cottonseed hulls.....		21.88		
Sorghum silage.....			50.96	
Sagrain silage.....				42.53
Feed required per 100 lb. gain, lbs.:				
Cottonseed meal.....	335.88	330.84	350.29	376.43
Johnson grass hay.....	153.84	151.53	160.44	172.41
Corn silage.....	2223.0			
Cottonseed hulls.....		1105.0		
Sorghum silage.....			2725.0	
Sagrain silage.....				2444.0

Note: The selling price for the steers in Lots 1 and 2 were slightly more than those in Lots 4 and 5 due to a better finish.

Reference: Mississippi Agricultural Experiment Station Press Circular 359, pages 1 and 2, Table I, "Comparison of Roughages for Finishing Steers," May, 1928, State College, Mississippi.

Suggestive: Which lot showed the highest total gain per steer? Do the results of this test indicate that cottonseed hulls are worth more as a roughage for finishing beef steers when fed with cottonseed meal and Johnson grass hay? With corn silage? Sorghum silage? Sagrain silage? Under conditions prevailing in your locality, which roughage could be produced most economically on your farm?

III

Varying Amounts of Cottonseed Hulls and Sorghum Silage Compared for Finishing Mature Steers at State College, Mississippi, 1930-1932.

The plan of the experiment was to divide 32 common mature steers into 4 lots of 8 steers each and feed them the following rations:

Lot 1: Cottonseed meal, 5 to 7 pounds; sorghum silage, ad libitum; Johnson grass hay, 3 pounds.

Lot 2: Cottonseed meal, 5 to 7 pounds; $\frac{3}{4}$ sorghum silage, $\frac{1}{4}$ cottonseed hulls, ad libitum; Johnson grass hay, 3 pounds.

Lot 3: Cottonseed meal, 5 to 7 pounds; $\frac{1}{2}$ sorghum silage, $\frac{1}{2}$ cottonseed hulls, ad libitum; Johnson grass hay, 3 pounds.

Lot 4: Cottonseed meal, 5 to 7 pounds; Cottonseed hulls, ad libitum; Johnson grass hay, 3 pounds.

The first test was for a period of 106 days, the second 99 days, and the third 120 days. In order to check the gains made, individual weights were taken every 14 days during the progress of the experiment. On the second weighing day, at the beginning of each test the steers were divided as nearly as possible with reference to quality, weight and condition into 4 equal lots and started on the experimental rations. They were fed daily, at 7 A. M. and 5 P. M., on all feeds except hay, which was all fed at the evening feed. The silage, hulls and combinations of silage and hulls were fed ad libitum and the hay was limited to 3 pounds per steer. Two pounds of cottonseed meal per steer were fed for the first 4 days. The meal was increased 1 pound each 4 days until 6 pounds were being fed. This amount was fed during the first 60 days of the test. Seven pounds were fed during the next 30 days and 8 pounds were fed during the remainder of the test. The cottonseed meal was thoroughly mixed with the silage and hulls and silage and hulls mixture. Adjustments were made on a dry weight basis in mixing the cottonseed hulls and sorghum silage, 3 pounds of silage being allowed for each pound of cottonseed hulls fed. In Lot 2 the ratio was 1 pound of cottonseed hulls to 9 pounds silage and in Lot 3 the ratio was 1 pound of cottonseed hulls to 3 pounds silage.

Fresh water was supplied to each lot in concrete troughs and block salt was available at all times.

The steers used in the three trials were of Jersey breeding, commonly termed Yellow Hammers, and were 2 years old or older. All cattle used were dehorned.

All the steers went on feed with good appetites and in neither test were there any indications of scouring. During the 1932-33 test one steer in Lot 3 went off feed and failed to gain in weight about 60 days after the test had begun and was removed from the experiment. All steers in the 1932-33 trial, for some unknown reason, made small daily gains.

The four lots of cattle received as nearly the same treatment as was possible during the experimental feeding period. Each lot was fed under a shed 30 feet long and 16 feet wide. These sheds opened into lots approximately $\frac{1}{7}$ acre in size. The lots became very muddy during the rainy weather, but the stalls

were bedded with oat straw as often as it was necessary to keep them dry. All the feeding was done by student labor under the supervision of the Animal Husbandry Department of the Experiment Station.

Table 55—Cottonseed Hulls Versus Sorghum Silage Versus Varying Amounts of Cottonseed Hulls and Sorghum Silage for Finishing Mature Steers at State College, Miss., 1930-32. Summary of 3 trials—Average Length of Test—108 days.

	Lot 1	Lot 2	Lot 3	Lot 4
	C. S. Meal Sorghum Silage J. G. Hay	$\frac{1}{4}$ C. S. Meal $\frac{3}{4}$ C. S. Hulls Sorghum Silage J. G. Hay	C. S. Meal $\frac{1}{2}$ C. S. Hulls Sorghum Silage J. G. Hay	C. S. Meal C. S. Hulls J. G. Hay
No. steers per lot	24	24*	24	24
Av. initial wt., lbs.	874.4	879.0	872.7	875.3
Av. final wt., lbs.	1036.7	1058.3	1051.3	1041.0
Av. gain per steer, lbs.	162.3	179.3	178.6	165.7
Av. daily gain, lbs.	1.50	1.65	1.65	1.53
Feed consumed per daily ration, lbs.:				
Cottonseed meal	5.94	5.94	5.94	5.94
Cottonseed hulls		6.45	14.28	31.10
Sorghum silage	67.08	58.05	42.46	
J. G. Hay	3.00	3.00	3.00	3.00
Feed required per 100 lb. gain, lbs.:				
Cottonseed meal	414.0	365.0	364.5	392.3
Cottonseed hulls		392.1	859.0	2061.0
Sorghum silage	4493.2	3528.8	2577.2	
J. G. Hay	207.1	183.3	183.1	197.7
Shrinkage per cent	7.34	6.70	6.93	6.99
Dressing per cent (Market wt.)	56.78	56.21	57.24	57.39

*In the 1932-33 trial, one steer was removed from Lot 2.

Reference: Mississippi Agricultural Experiment Station Bulletin 301, pages 1, 2 and 7, Table VI, "Varying Amounts of Cottonseed Hulls and Sorghum for Finishing Mature Steers," November 1933, State College, Mississippi.

Suggestive: Under your conditions, could you better afford to feed sorghum silage or cottonseed hulls?

IV

A Ration of Cottonseed Meal and Hulls Versus a Ration of Cottonseed Meal, Silage and Hay for Fattening Beef Cattle at College Station, Texas, 1911-12.

The purpose of this experiment was to ascertain whether or not cottonseed meal and silage may be used more profitably for fattening cattle than cottonseed meal and cottonseed hulls.

The Cattle Used—The cattle used in this experiment were range bred three and four year old grade Shorthorn and Hereford steers, all of which were dehorned. They were the "tops" of the bunch of about 200 head and were fairly uniform as to conformation, quality and condition.

Method of Feeding—The ration per steer for the first day, December 8, was as follows:

Lot 1. Three pounds cottonseed meal, 19½ pounds cottonseed hulls.

Lot 2. Three pounds cottonseed meal, 24-1/5 pounds silage.

Hay was added to the ration of Lot 2 on January 8. This addition was made because the steers on this lot were not eating a sufficient quantity of the silage, possibly because of its succulent character, to afford them as much dry matter as was being consumed by those in Lot 1. They were supplied with hay until the end of the experiment. After the first few days, as much hulls for Lot 1 and as much silage for Lot 2 were supplied as the steers would clean up, the daily amount for each steer being about 20-2/3 pounds of hulls and about 50 pounds silage.

The cottonseed meal for both lots was gradually increased. On January 6, the amount reached 6 pounds per head daily for each lot. This amount remained unchanged until February 11, when 7 pounds cottonseed meal was fed per steer in each lot. This amount remained unchanged for the remainder of the experiment.

The cattle were fed twice daily, early in the morning and late in the afternoon. The meal and hulls were thoroughly mixed in the feed troughs. The silage was placed in the trough and the meal sprinkled over it and the two feeds thoroughly mixed with an ordinary hull-fork. The hay was supplied in a separate trough.

Feeds Used—The feeds used, namely, cottonseed meal, cottonseed hulls and hay, were of various qualities.

The silage was composed chiefly of Milo maize which had been harvested when the heads were about mature and the stalks and leaves were still green. The other components of the silage were sorghum and Indian corn. It was estimated that the larger portion of the silage fed consisted of about 75 per cent milo maize, 15 per cent Indian corn, and 10 per cent sorghum.

The hay was composed of sorghum and Johnson grass, about half and half.

The cottonseed meal used analyzed about 45 per cent protein.

The steers were divided into uniform lots and fed the following ration:

Lot 1. Cottonseed meal and cottonseed hulls.

Lot 2. Cottonseed meal, silage, and during a part of the experiment, mixed sorghum and Johnson grass hay.

Details of the experiment are given in the following table.

Table 56—Cottonseed Hulls Versus Silage for Fattening Beef Cattle at College Station, Texas. December 8, 1911 to April 4, 1912. Length of Test—119 Days.

Ration	Lot 1 C. S. Hulls	Lot 2 Silage
No. of steers per lot	15	25
Av. initial weight, lbs.	895	909
Av. final weight, lbs.	1131	1151
Av. gain per steer, lbs.	236	242
Av. daily gain, lbs.	1.98	2.03
Av. daily ration, lbs.:		
Cottonseed meal	5.98	5.98
Cottonseed hulls	27.87	—
Silage	—	47.57
Hay	—	3.
Av. feed required per 100 lb. gain, lbs.:		
Cottonseed meal	301.9	295.9
Cottonseed hulls	1405.4	—
Silage	—	2339.0
Hay	—	115.

Note: There was practically no difference in the shrinkage of the 2 lots in shipping, and there was no difference in the dressing per cent of the 2 lots.

Reference: Texas Agricultural Experiment Station Bulletin 152, pages 3, 6, 7, 8 and 9, Table II, "A Test of the Relative Values of Cottonseed Meal and Silage and Cottonseed Meal and Cottonseed Hulls for Fattening Cattle," August 1912, College Station, Texas.

Suggestive: Which lot of steers produced the more economical gain? (Use current prices).

V

Cottonseed Hulls Compared With Sorgo Silage and Sorgo Fodder as a Roughage for Fattening Calves at College Station, Texas, 1923-1926.

Object—This experiment was planned for the purpose of determining the relative feeding values of sorgo silage, sorgo fodder, and cottonseed hulls, respectfully, as sources of roughage in the rations of fattening calves.

Comparisons were made in three consecutive years, 1923 to 1925, inclusive, of sorgo silage, sorgo fodder, and cottonseed hulls, when fed in conjunction with milo heads and cottonseed meal, to fattening calves. The experiment was conducted cooperatively by the Bureau of Animal Industry and Plant Industry of the U. S. Department of Agriculture and the Agricultural Experiment Station of the Agricultural and Mechanical College of Texas, at the Big Spring Field Station, located near Big Spring, Texas.

Cattle Used—In each of the three tests representative groups of well-bred Hereford calves of weaning age were fed. The calves were divided as equally as possible with reference to size and type into three groups. The respective periods of feeding varied from 168 to 203 days in the three tests.

The rations fed:

Lot 1. Ground milo heads, cottonseed meal, sorgo silage and Sudan grass hay.

Lot 2. Ground milo heads, cottonseed meal and cottonseed hulls.

Lot 3. Ground milo heads, cottonseed meal and sorgo fodder.

An open shed 20 feet deep by 78 feet in length (south exposure) provided shelter to protect the calves during inclement weather. Each lot had an area of 60 feet by 26 feet. A fresh supply of water was available at all times. A liberal supply of granulated stock salt was available in boxes under the shed throughout the feeding period. The feed lots were situated on a sandy loam soil and mud was not a serious factor even during wet weather.

The calves were fed twice each day, the morning feed being given about 8 A. M. and the evening feed about 6 P. M. The concentrates, consisting of ground milo heads and cottonseed meal, were weighed and then thoroughly mixed before being spread over and carefully mixed with the respective roughages in the feed bunks.

The sorgo fodder which was supplied to Lot 3 was run through the silage cutter before being fed. Sudan grass hay was fed once daily to Lot 1, this roughage being placed in the feed bunk after the calves had consumed the bulk

of the silage-concentrate mixture. In the first test, all lots received the same amount of cottonseed meal. However, during the second and third tests Lot 2, receiving cottonseed hulls, was fed a slightly increased amount of meal as compared with the other two lots for the purpose of determining whether this would tend to offset the lower feeding value of the cottonseed hulls fed to Lot 2. The calves used in all three tests were high-grade Herefords.

The feeds used in all of the tests were of good quality. The cottonseed meal used sold under a guarantee of 43 per cent protein. The milo heads were finely ground and there was practically no waste either of grain or ground head roughage. The sorgo silage was made from the first cutting of the sumac variety of sweet sorghums, and was of good quality. The sorgo fodder was also of the first cutting and was of good quality. The cottonseed hulls were of a fair to good quality. The Sudan grass hay fed to Lot 1 was of good quality.

Table 57—Cottonseed Hulls Compared With Sorgo Silage and Sorgo Fodder as a Roughage for Fattening Calves at College Station, Texas. 1923-26.
A Three Year Average. (Average Length of Trials 162 Days).

Rations	Lot 1 Silage	Lot 2 C. S. Hulls	Lot 3 Fodder
No. steers per lot	15	15	15
Av. initial feed lot wts., lbs.	415	363	413
Av. final feed lot wts., lbs.	776	707	756
Av. gain per head, feed lot wt., lbs.	361	344	343
Av. daily gain per head, feed lot wt., lbs.	2.	1.6	1.9
Av. daily ration, lbs.:			
Ground milo heads	9.59	9.61	9.61
Cottonseed meal	1.72	1.86	1.73
Sorgo silage (sumac)	16.49		
Cottonseed hulls		8.95	
Sorgo fodder (sumac)			9.15
Sudan grass	1.45		
Feed required per 100 lbs. gain, lbs.:			
Ground milo heads	483	604	509
Cottonseed meal	87	116	92
Sorgo silage (sumac)	827		
Cottonseed hulls		569	
Sorgo fodder (sumac)			483
Sudan grass	87		

Note: The calves fed cottonseed hulls did not possess the finish that were found in the calves fed silage and the calves fed fodder. There was little difference in the finish between the calves fed silage and those fed fodder. The lot fed silage seemed before slaughter to possess slight advantage in this respect in the first two tests while the calves fed fodder showed a slightly higher finish in the third experiment. However, the carcasses from Lots 1 and 3 on a three year average were about the same in quality. Those from Lot 1 fed silage had a slight advantage the first year, and Lot 3 a considerable advantage the last year. Judging from the internal fat, Lot 3 fed fodder showed more finish in each test.

Reference: Texas Agricultural Experiment Station Bulletin 363, pages 7, 8, 9, 15, 21, 27 and 35.

Suggestive: Was there enough difference in the total gain per steer in each lot to justify changing from one feed to the other if the prices were approximately the same? In your locality, are the roughages in this experiment obtainable? Which roughage could be produced on your farm most economically?

VI

Cottonseed Hulls Versus Corn Silage as a Roughage for Fattening Beef Cattle at Clemson College, South Carolina. 1912.

The object of this test was to determine the relative value of cottonseed hulls and corn silage as a roughage for beef cattle when fed with cottonseed meal.

Cattle Used—The cattle used were all dehorned and were chiefly grade Shorthorns of fair quality.

Method of Feeding—The cattle were fed in an open shed 25x100 feet with a feed trough extending length-wise through the middle. The steers were started on ½ pound cottonseed meal per 100 lb. live weight per day and at the end of the second week, they were increased to 5 pounds per day. This was gradually increased to 7 pounds per day for 2nd month and 8 pounds per day for the last 40 days. Both lots were fed in exactly the same manner, the only difference being the roughage fed. The cattle were fed twice a day and had access to water and salt at all times.

Feeds Used—The cottonseed meal used in this test was 36 per cent protein. The silage and hulls fed were of good quality.

Each lot was fed the following ration:

Lot 1. Cottonseed meal and corn silage.

Lot 3. Cottonseed meal and cottonseed hulls.

Details of the experiment are given in the following table.

Table 58—Cottonseed Hulls Versus Corn Silage for Fattening Beef Steers at Clemson College, South Carolina, 1912. Length of Test—102 Days.

Ration	Lot 1	Lot 3
	Corn Silage	Cottonseed hulls
No. of steers per lot	20	20
Av. initial weight, lbs.	890	890
Av. final weight, lbs.	1112.36	1043.
Av. gain per steer, lbs.	222.36	153.
Av. daily gain, lbs.	2.18	1.5
Av. daily ration, lbs.		
Corn silage	40.	.....
Cottonseed hulls .....	.....	25
Cottonseed meal	6.3	6.3
Av. feed required per 100 lb. gain, lbs.:		
Corn silage	1684.	.....
Cottonseed hulls .....	.....	1786.
Cottonseed meal	322	469

Reference: South Carolina Agricultural Experiment Station Bulletin 169, pages 4, 5, 6, 8 and 10, Tables I and III, "Feeding Beef Cattle in South Carolina," September, 1912, Clemson, South Carolina.

Suggestive: Which lot made the most gain per steer? What was the difference in the ration of the two lots? Which roughage produced the most economical gain, hulls or silage? Which lot required the most meal per 100 lb. gain?

VII

Cottonseed Hulls Versus Corn Silage for Fattening Beef Cattle at Raleigh, North Carolina, 1909-11.

The purpose of this test was to determine the difference in the feeding value of corn silage and cottonseed hulls when fed with cottonseed meal for fattening beef cattle.

Cattle Used—The steers used in this test were fairly uniform in size and type, averaging about 900 pounds in weight both years. They were principally Short-horn grades, although some showed traces of other blood. On the whole they would class as average feeders in the Southern States.

Method of Feeding—The steers were fed regularly twice each day, at 7:00 in the morning, and at 5:00 in the afternoon. The corn silage was fed in troughs and distributed uniformly, after which the cottonseed meal was spread over and thoroughly mixed with the silage. These rations were consumed readily when prepared in this manner. The cottonseed hulls were put in the through, the meal sprinkled over it uniformly, and thoroughly mixed.

Feeds Used—The cottonseed meal used in this test was the ordinary commercial product. During the first year of the test, the corn silage was inferior, principally because of the small number of ears on it. In the second year, the corn silage was superior, principally because of the large number of ears it contained.

The steers were fed in a barn. The stalls were located on the south side and were 15x20 feet. They were connected with lots 20 feet wide by 80 feet long. The steers were kept in the stalls during the night and a large part of the day.

Water was kept before the steers at all times.

The steers were divided into two lots equal in uniformity, size and weight, and fed the following ration:

Lot 2. Cottonseed meal and corn silage.

Lot 3. Cottonseed meal and cottonseed hulls.

Details of the experiment are given in the following table.

Table 59—Cottonseed Hulls Versus Corn Silage for Fattening Beef Cattle at Raleigh, North Carolina. 1909-1911. Average Length of Experiment—112 Days.

The 1909 to 1910 test ran from November 6, to February 26.

The 1910 to 1911 test ran from October 12, to January 31.

Ration	Lot 2	Lot 3
	C. S. Meal Corn Silage	C. S. Meal C. S. Hulls
No. of steers per lot	6	6
Av. initial weight, lbs.	918	923
Av. final weight, lbs.	1063	1084
Av. gain per steer, lbs.	144	161
Av. daily gain, lbs.	1.29	1.44
Av. daily ration, lbs.		
Cottonseed meal	7.45	7.45
Cottonseed hulls		19.74
Corn silage	33.95	
Av. feed required per 100 lb. gain, lbs.		
Cottonseed meal	577	517
Cottonseed hulls		1371
Corn silage	2634	

Reference: North Carolina Agricultural Experiment Station Bulletin, 218, pages 30, 31, 34 and 36, Table IV, "Feeding Experiments With Beef Cattle," July 1911, Raleigh, North Carolina.

Suggestive: Which lot required the most cottonseed meal per 100 lb. gain? Which lot made the most economical gain? Which roughage would you feed?

VIII

Immature Corn Silage Versus Cottonseed Hulls as a Basal Winter Ration for 2 Year Old Heifers, Manhattan, Kansas, 1934-35.

Immature corn silage and cottonseed hulls were full fed to Lots 1 and 2 respectively. The heifers in Lot 3 received one-half the amount of cottonseed hulls fed to Lot 2 plus all the immature corn silage they would clean up. In addition to roughage, each lot was fed cottonseed meal at the rate of two pounds per head daily and Bomin, a mixture of bone meal and ground limestone, at the rate of 1/10 pound per head daily. The immature, drouth-stricken corn had reached the tasseling stage when it was put into the silo August 15, 1934.

Table 60—Immature Corn Silage Versus Cottonseed Hulls as a Basal Winter Ration for 2 Year Old Heifers at Manhattan, Kansas. December 18, 1934 to February 12, 1935—A 56 Day Test.

Ration	Lot 1	Lot 2	Lot 3
	Immature Corn Silage C. S. Meal Bomin	C. S. Hulls C. S. Meal Bomin	Immature Corn Silage C. S. Hulls C. S. Meal Bomin
No. of heifers per lot	8	8	8
Av. initial weight per heifer, lbs.....	1117.50	1111.04	1115.42
Av. final wt. per heifer, lbs.	1257.29	1159.58	1229.38
Av. total gain per heifer, lbs.	139.79	48.54	113.96
Daily gain per heifer (av.), lbs.....	2.50	.87	2.04
Av. daily ration per heifer, lbs.:			
Immature corn silage	71.13	.....	42.12
Cottonseed hulls .....	.....	22.22	11.11
Cottonseed meal	2.00	2.00	2.00
Bomin	.10	.10	.10
Av. feed required per 100 lb. gain, lbs.:			
Immature corn silage	2845.2	.....	2063.08
Cottonseed hulls .....	.....	2555.3	544.9
Cottonseed meal	80.0	230.0	98.0
Bomin	4.0	11.5	4.9

Reference: Kansas Agricultural Experiment Station Circular 35, pages 2 and 3, Table II, "Cattle Feeding Experiments," May 1935, Manhattan, Kansas.

Suggestive: How much gain was made per heifer in Lot 1? In Lot 2? In Lot 3? To what can this difference in gain be attributed? Calculate the number of tons of cottonseed hulls required to equal one ton immature corn silage in feeding value.

2—COTTONSEED HULLS VERSUS DRIED ROUGHAGES.

I

Cottonseed Hulls Versus Chopped Sagrain Fodder for Fattening Baby Beef Cattle at Stoneville, Mississippi. 1932-33, 1934-35.

Object—In order to learn something of the comparative value of cottonseed hulls and other roughages, the Stoneville Experiment Station conducted an experiment with grade calves with some marking of Hereford blood.

The calves were permitted to run on stalk and soybean field before putting them on the finishing feed. On December 20, the calves were divided as nearly equal as possible according to quality, sex and size. Good water and large well drained feed lots were made available for the experiment.

The ration fed each lot per 1000 pounds live weight daily, during the years 1932-33, were as follows:

Lot 1. Alfalfa hay 2.31 lbs.; chopped sagrain fodder 25.31 lbs.; cottonseed meal 7.23 lbs.; crushed sagrain (grain) 16.22 lbs.

Lot 2. Alfalfa hay 2.31 lbs.; cottonseed hulls 24.72 lbs.; cottonseed meal 7.24; crushed sagrain (grain) 16.24 lbs.

The following rations were fed in 1934-35:

Lot 1. Alfalfa hay 2.52 lbs.; cottonseed hulls 14.19 lbs.; cottonseed meal 22.22 lbs.; crushed corn 2.52 lbs.

Lot 2. Alfalfa hay 2.47 lbs.; chopped sagrain fodder 7.73 lbs.; cottonseed meal 23.30 lbs.; crushed corn 2.47 lbs.

Details of the experiment are given in the following table.

Table 61—Cottonseed Hulls Versus Chopped Sagrain Fodder as a Roughage for Fattening Baby Beef Cattle at Stoneville, Miss., 1932-33, 1934-35.
A Two Year Average—120 Days Each Year.

Ration	Lot 1	Lot 2
	C. S. Hulls	Chopped Sagrain Fodder
Av. No. of calves	16	16
Av. initial wt. per calf, lbs.	426.1	425.6
Av. final wt., lbs.	642.3	641.3
Av. gain per calf, lbs.	216.2	215.7
Av. daily gain per calf, lbs.	1.78	1.78
Feed required per 100 lb. gain, lbs.:		
Alfalfa hay	57.78	57.41
Cottonseed hulls	455.1	.....
Ground sagrain	373.4	367.61
Crushed corn	62.4	62.3
Sagrain fodder .....	.....	439.4

Reference: Mississippi Agricultural Branch Experiment Station Service Sheet 154 and Service Sheet 109, 1933-1935, Stoneville, Mississippi.

Suggestive: Did the cottonseed hulls make more total gain per calf than the sagrain fodder? Which of the roughages could be most conveniently fed on your farm?

II

Sumac (Cane) Fodder, Sumac Fodder and Alfalfa, and Cottonseed Hulls and Alfalfa Hay Compared as Roughages in Rations of Fattening Yearling Steers, Big Spring, Texas, 1930-1931.

This experiment was conducted at the U. S. Experiment Station at Big Spring by the Bureau of Animal and Plant Industries, in cooperation with the Agricultural Experiment Station, Texas A. & M. College.

The object of this test was to determine the comparative feeding values of (1) Sumac Fodder (heads included); (2) Sumac fodder and approximately 4 pounds of alfalfa hay, as roughages.

The cattle used in this experiment were thirty head of good representative Hereford yearling feeder steers, averaging approximately 611.2 pounds, were purchased from Tom Good, Big Spring, Texas, at a price of 8 cents per pound, with a 3 per cent shrinkage and were delivered to the Experiment Station at Big Spring, December 12, 1930. The steers were divided into 3 uniform groups of 10 each.

In this experiment, three different rations were fed on a basis of equal amounts of digestible protein for each of the respective lots. Calculation of rations were based largely on analyses and productive feeding values of Texas feeds by Fraps, and in view of the fact that the Sumac fodder (due to the unfavorable 1930 growing season) was for the most part inclined to be immature, there is the possibility that the total digestible nutrients in the rations received by Lots 1 and 2 might have been slightly lower than the amount shown in the calculated ration.

Table 62—Sumac Fodder Versus Sumac Fodder and Alfalfa Hay Versus Cottonseed Hulls and Alfalfa Hay, Big Spring, Texas, 1930-31. (A 140 day test).

	Lot 1	Lot 2	Lot 3
	Gr. milo hds., C. S. meal, Sumac Fodder	Gr. milo hds., C. S. meal, Sumac Fodder Alfalfa Hay	Gr. milo hds., C. S. meal, C. S. Hulls Alfalfa Hay
No. of steers	10	10	10
Av. initial wt. at feed lot, lbs.	611.2	611.5	611.2
Av. final wt. at feed lot, lbs.	975.23	956.95	995.97
Av. gain per head, feed lot, wts., lbs.	364.03	345.45	384.77
Av. daily gain per head, feed lot, wts., lbs.	2.6	2.47	2.75
Shrinkage per head during shipment to market, %	5.82	4.54	5.72
*Average daily ration, lbs.:			
Ground milo heads	12.24	12.76	13.03
Cottonseed meal	2.49	1.65	1.98
Sumac fodder (red top)	13.98	8.86	.....
Alfalfa hay .....	.....	4.20	4.18
Cottonseed hulls .....	.....	.....	9.01
*Feed required per 100 lbs. gain, lbs.:			
Ground milo heads	470.7	516.9	474.2
Cottonseed meal	95.6	66.8	71.9
Sumac fodder (red top)	537.8	358.9	.....
Alfalfa hay .....	.....	170.4	152.1
Cottonseed hulls .....	.....	.....	327.8
*Total feed consumed per head, lbs.:			
Ground milo heads	1713.6	1785.8	1824.7
Cottonseed meal	348.2	230.9	276.6
Sumac fodder (red top)	1957.8	1239.9	.....
Alfalfa hay .....	.....	588.5	585.1
Cottonseed hulls .....	.....	.....	1261.4
Salt consumed per head, lbs.	6.4	5.3	5.4

*Waste or rejected feeds were not deducted in summarizing data.

Note: The dressed yield of the respective lots was as follows: Lot 1, fed Sumac fodder, 58.9 per cent; Lot 2, fed Sumac fodder and alfalfa, 59.5 per cent; Lot 3, fed cottonseed hulls and alfalfa, 59.8 per cent.

The weight of internal fat, consisting of the caul and ruffle fat, was obtained from the individual carcasses, this being considered a partial index of the fatness of each group. The average weight of internal fat per head for each of the lots was: Lot 1—19.98 pounds; Lot 2—22.48 pounds; and Lot 3—22.65 pounds.

The Lot 3 steers, which received cottonseed hulls and alfalfa hay as roughage, showed a slight advantage in dressed yield and weight of internal fat over the other two groups. The Lot 1 carcasses, however, graded highest of the 3 lots, while those constituting Lot 2 ranked second, and those in Lot 3 ranked third.

All unconsumed, or rejected roughage was weighed back, the percentage of rejected feed being as follows: Lot 1—one per cent; Lot 2—one and three tenths per cent; Lot 3—one and two tenths per cent.

Reference: U. S. Experiment Station, Big Spring, Texas, Cattle Feeding, Series No. 2.

Suggestive: Which lot made the highest average gain per head? What were the constituents of the ration fed Lot 3? What is the cost per pound of gain in Lot 2? In Lot 3? In which lot did the carcasses grade lowest? Which ration would you feed to yearling steers?

III

Cottonseed Hulls Versus Sorghum Hay for Fattening Cattle at College Station, Texas, 1912-1913.

The basal ration used in this test consisted of cottonseed meal, either ground Kafir corn or milo maize, and silage. The purpose, therefore, was to compare sorghum hay and cottonseed hulls as supplements to this ration.

The cattle used were 32 head of range-bred, high grade Hereford steers two years past in age. They were a fairly uniform lot, most of them of very good feeder conformation and above the average in quality. All were rather thin in condition, but thrifty when the experiment began.

On the morning of October 16, 1912, the steers were divided into two lots, designated as Lot V and Lot VI, each containing 16 head. The division was made equally with regard to type, quality, condition and weight.

The two pens in which the lots were fed were each 60x100 feet in area and equal in all respects. Water and salt were amply provided. From the beginning of the experiment until January 6, the two lots had no shelter, whatever. Thereafter, each was protected by a shed, 14x36 feet, open on the south side. The cattle were, of course, subjected to the same weather conditions.

The two lots were fed the same ration with the exception of the kind of roughage. Lot V was fed cottonseed meal, ground milo maize or Kafir corn, cottonseed hulls and silage. Lot VI was fed identically the same ration except the cottonseed hulls were replaced by sorghum hay.

The ration per steer in each lot at the beginning of the experiment was 2 pounds of cottonseed meal, 4 pounds milo maize chops, 12 pounds silage. Lot V received 10 pounds cottonseed hulls and Lot VI 10 pounds Sorghum hay in addition to the above ration. This ration was gradually increased by periods until at the end of the experiment the ration per steer in each lot was 4 pounds cotton-

seed meal, 18 pounds Kafir chops, 17 pounds silage. Steers in Lot V were receiving 24 pounds cottonseed hulls and steers in Lot VI were receiving 24 pounds sorghum hay per head daily.

The rations were carefully weighed and supplied to the cattle in two parts, one early in the morning and the other late in the afternoon. All of the feeds were thoroughly mixed in the feed troughs, with the exception of the sorghum hay for Lot VI, which was placed in a rack.

Table 63—Cottonseed Hulls Versus Sorghum Hay for Fattening Beef Cattle, College Station, Texas, Oct. 16, 1912 to March 4, 1913—140 Days.

	Lot V Cottonseed hulls	Lot VI Sorghum hay
No. of steers	16	16
Av. initial wt., lbs.	777.5	775.6
Total gain per head, lbs.	413.1	431.6
Av. daily gain per head, lbs.	2.97	3.1
Total feed consumed per head, lbs.:		
Cottonseed meal	477.	477.
Milo maize chops	318.1	318.1
Ground kafir heads	187.5	187.5
Kafir chops	1461.	1461.
Cottonseed hulls	906.	
Silage	2549.4	2549.4
Sorghum hay		906.
Feed per 100 lb. gain per head, lbs.:		
Cottonseed meal	115.5	110.5
Milo maize chops	77.	73.7
Ground kafir heads	45.4	43.4
Kafir chops	353.6	338.5
Cottonseed hulls	219.3	
Silage	617.1	590.7
Sorghum hay		209.9

Note: The cattle took to their rations readily, and at no time during the test was there a steer in either lot "off feed" or affected with scours. After only two or three days the cottonseed meal, grain and silage in both lots were gradually increased, but at no time during the experiment was the cottonseed hulls and sorghum hay more than 10 pounds a head daily. On December 16, it was found necessary to begin a gradual reduction in these two feeds, from the fact that the other portion of the rations, especially the meal and grain, had been increased to such an extent, that the cattle could no longer eat as much roughage as they had been eating. After February 15, the hulls and hay were left off altogether, silage being the only roughage fed for the rest of the period. Milo maize chops was fed from the beginning of the experiment until November 24, after which ground Kafir corn heads was substituted for it and used until December 4. After this, threshed ground Kafir corn or Kafir corn chops was fed, with the exception of two days, viz: December 17 and 19, on which ground heads was again fed. The change from sorghum-cowpea silage to corn silage took place on February 1, the same as in the other experiment.

Reference: Texas Agricultural Experiment Station Bulletin 159, pages 24, 25, 26 and 30, Table XVIII, "Steer Feeding," July 1913, College Station, Texas.

Suggestive: What was the average daily gain in Lot V? In Lot VI? What is the comparative cost of 100 pounds gain in each lot (use current prices). Which would it be more convenient for you to feed, hulls or sorghum hay?

SECTION E—OTHER STUDIES WITH COTTONSEED PRODUCTS AS A FEED FOR BEEF CATTLE.

I

Vitamin A Studies in Cottonseed Meal With Beef Cattle, Raleigh, N. C. 1930.

By the curative method five steers of seven to eight hundred pounds in weight were fed the basal ration of 50% cottonseed meal, 25% each of cottonseed hulls, and beet pulp with minerals supplied. The steers developed Vitamin A deficiency symptoms in five and one-half to seven months, and died unless Vitamin A was supplied from some other source.

In 1931-32 the curative and preventive methods were used by feeding eight younger heifer calves of three to four hundred pounds in weight. Two were on the above basal ration, while two were placed on the basal ration in which yellow corn replaced one-half of the cottonseed meal. Four were fed the basal ration to which cod liver oil was added daily or in which 9.1 per cent alfalfa leaf meal was used.

The heifers on the basal and yellow corn rations developed Vitamin A deficiency symptoms which were relieved by supplying Vitamin A in cod liver oil. Those fed cod liver oil and alfalfa leaf meal daily in the ration fared better and made consistent gains.

The necessity of supplying some source of Vitamin A to the ration when feeding relatively large amounts of cottonseed meal has been demonstrated by both the supplemental and preventative methods of feeding.

The work completed the past year has shown that cattle on heavy cottonseed meal rations do not develop Vitamin A deficiency symptoms when cod liver oil is supplied with the basal ration. After the symptoms have become pronounced, cod liver oil added to the ration has a marked curative effect.

Cottonseed meal can constitute as high as 50 per cent of the ration for growing beef cattle and fattening yearlings over a period much longer than is necessary when the ration is adequately supplemented with feeds rich in Vitamin A, such as alfalfa leaf meal and cod liver oil.

Another trial of this experiment was started in the fall of 1932. Eight high grade Shorthorn heifer calves of similar breeding, age, type, and former treatment were selected. These were March and April calves and had been running on pasture all summer. A few of them were still nursing, but most of them had been weaned a short time.

The calves were divided into groups of two each and started on feed November 7. Each group received 26% of cottonseed meal, 26% of corn, and 1% mineral mixture. Group 1 received yellow corn, but Groups 2, 3 and 4 received white corn. In addition, the Group 1 mixture contained 22% cottonseed hulls and 25% dried beet pulp.

Group 2, 27% cottonseed hulls and 20% alfalfa hay.

Group 3, 27% cottonseed hulls and 20% soybean hay.

Group 4, 17% cottonseed hulls and 30% soybean hay.

They were full fed the above rations until April 6, when they were destroyed by fire. During the 140 day feeding period (last weights taken March 28) the average daily gains for Groups 1, 2, 3 and 4 were 2.10 lbs., 1.98 lbs., 2.04 lbs., and 1.81 lbs., respectively. On April 6 all calves were looking all right and were apparently in good health.

The experimental period was too short for a deficiency in Vitamin A in the ration to show any definite effect. The data for 140 days show that the only source of Vitamin A, alfalfa or soybean hay or yellow corn, apparently supplied sufficient Vitamin A for the heifers to make uniform total gains and feed consumption with the exception of the last two, Nos. 7 and 8, receiving 30 per cent soybean hay in the ration.

Reference: North Carolina Agricultural Experiment Station Fifty-Fifth Annual Report, pages 50 and 51, December, 1932, and Fifty-Sixth Annual Report, pages 48 and 49, December, 1933, Raleigh, North Carolina.

II

The Palatability of Cottonseed and Linseed Meals Compared as a Protein Concentrate Feed for Cows and Calves, East Lansing, Michigan, 1935.

"Considerable variation in feed consumption has been noted when beef calves have been fed individually on heavy grain rations containing cottonseed meal as a chief source of protein. An opportunity appeared in a trial concerning economy of production and palatability of beef with calves fed individually, at the Michigan Agricultural Experiment Station, to study the palatability of cottonseed meal as compared with a feed like linseed meal, which is ordinarily considered quite palatable.

Twelve heifer and twelve steer calves were fed by the reversal method, using 43 per cent protein cottonseed meal in the mixture for one-half the calves in each group and 37 per cent protein linseed meal for the remaining calves. Six calves were fed 105 days, reversing the two feeds at the end of each 28-day period for each calf; six calves were fed 154 days, and 12 calves were continued on feed 203 days, following a similar procedure in regard to feeding in each case, except that the last two periods for the twelve calves were 42 and 49 days in length.

All calves were fed as much as they desired of a mixture consisting of shelled corn 6 parts, cottonseed or linseed meal 1 part, corn silage 3.5 parts and cut alfalfa hay 2 parts, by weight. These proportions of feed were consumed by calves fed together in lots in three previous experiments, receiving as much of each feed as they desired. They were fed twice daily in individual stalls and released in two large pens for the day and night. Granulated salt, steamed feeding bone meal and ground limestone were available to both groups.

No differences in feed consumption, indicating a preference for either feed, were noted when the calves were changed from one feed to the other. The ration contained a large proportion of grain, and feed consumption varied from time to time, but there was no apparent relation between changes in feed and feed consumption.

The 24 cattle received cottonseed meal a total of 2,044 days and made an average daily gain of 2.103 pounds, while the same cattle received linseed meal a total of 1,946 days and gained on the average of 2.140 pounds per day. The

average amount of feed required for each 100 pounds gain was exactly the same for each feed, a single weight was obtained on each animal at the time of changing feed, and no doubt variations in fill were responsible for some variations in weights and gains. It was noted that 12 cattle made a faster gain while receiving linseed meal, 10 gained more rapidly while receiving cottonseed meal and 2 cattle made exactly the same gain on each feed.

These data indicate that cottonseed meal, containing 43 per cent protein and linseed meal containing 37 per cent protein are approximately equal in palatability and efficiency when fed with corn, corn silage and alfalfa hay to fattening beef calves."

Reference: Michigan Agricultural Experiment Station Quarterly Bulletin, Vol. 18, No. 4, May, 1936. Page 253.

RESUME

Cottonseed Products Versus Other Feeds for Fattening Beef Cattle

Feed Compared	Place	Amount fed daily	Average daily gain	Average total gain per steer	Concentrates required per 100 lb. gain
Cottonseed meal.....	Laramie,	3.44	1.63	159.81	207.12
Linseed meal.....	Wyoming	3.44	1.08	106.11	311.94
Cottonseed cake.....	Fort Collins,	.98	2.01	390.5	48.8
Linseed oil cake.....	Colorado	.98	1.97	383.2	49.7
Cottonseed meal.....	State College	5.8	1.9	265.5	305.84
Velvet bean & pod meal.....	Mississippi	11.6	1.59	222.21	730.85
Cottonseed meal.....	Lafayette,	2.60	2.16	323.4	124.0
Soybean oil meal.....	Indiana	2.58	2.17	325.7	119.0
Cottonseed meal.....	Lafayette,	2.60	2.16	323.0	124.0
Whole soybeans.....	Indiana	2.59	2.25	337.0	115.0
Cottonseed meal.....	Manhattan,	11.04	2.39	334.0	462.81
Ground corn.....	Kansas	10.04	2.43	340.0	413.47
Cottonseed meal.....	Lafayette,	1.23	2.10	499.6	59.00
Whole soybeans.....	Indiana	1.24	2.08	494.4	59.00
Cottonseed meal.....	Lafayette,	2.28	2.45	367.9	93.00
Whole oats.....	Indiana,	4.87	2.16	324.2	225.00
Cottonseed meal.....	Lafayette,	2.28	2.45	367.9	93.00
Ground oats.....	Indiana	4.87	2.33	350.1	209.00
Cottonseed cake.....	Hays,	1.00	1.01	481.00	99.00
Ground kafir.....	Kansas	2.00	.92	437.50	217.6
Cottonseed meal.....	Hays,	1.00	1.01	481.00	99.00
Ground milo.....	Kansas	2.00	.88	421.40	227.26
Cottonseed meal.....	Hays,	1.00	1.01	481.00	99.00
Ground Barley.....	Kansas	2.00	.98	467.30	204.08
Cottonseed meal.....	Hays,	1.00	1.01	481.00	99.00
Ground wheat.....	Kansas	2.00	1.04	496.90	192.30
Cottonseed hulls.....	Manhattan,	22.22	.87	48.54	2555.3
Immature corn silage.....	Kansas,	71.13	2.50	139.79	2845.20
Cottonseed hulls.....	State College,	27.15	1.58	216.8	171.60
Goliad corn silage.....	Mississippi	45.32	1.78	243.8	258.80
Cottonseed hulls.....	State College,	27.15	1.58	216.8	171.60
Early amber sorg. sil.....	Mississippi	45.32	1.58	216.8	291.00
Cottonseed hulls.....	State College,	27.15	1.58	216.8	171.60
Cowpea & J. G. Silage.....	Mississippi	45.32	1.31	179.8	350.90
Cottonseed hulls.....	State College,	27.15	1.58	216.8	171.60
Goliad Corn Stover Silage.....	Mississippi	45.32	.65	71.4	707.70
Cottonseed hulls.....	State College,	31.10	1.53	165.7	2061.0
Sorghum Silage.....	Mississippi	67.08	1.50	162.3	4493.2
Cottonseed meal.....	McNeill,	5.1	2.1	178.0	242.8
Dry Velvet Beans.....	Mississippi	11.9	2.8	235.0	424.9
Cottonseed meal.....	McNeill,	5.1	2.1	178.0	242.8
Soaked Velvet Beans.....	Mississippi	11.9	1.04	88.0	540.8
Cottonseed meal.....	Lafayette,	2.95	2.41	404.9	121.39
Ground Soybeans.....	Indiana	2.92	2.32	390.0	125.85
Cottonseed hulls.....	College Station,	6.40	2.97	413.1	219.3
Sorghum Hay.....	Texas	6.40	3.1	431.6	209.9
Cottonseed hulls.....	Big Spring,	4.18	2.75	384.77	327.8
Alfalfa Hay.....	Texas	4.20	2.47	345.45	170.4
Cottonseed hulls.....	Stoneville,	.....	1.78	216.2	455.1
Chopped Sagrain Fodder.....	Mississippi	.....	1.78	215.7	439.4

RESUME—Continued.

Cottonseed Products Versus Other Feeds for Fattening Beef Cattle

Feed Compared	Place	Amount fed daily	Average daily gain	Average total gain per steer	Concentrates required per 100 lb. gain
Cottonseed hulls.....	Raleigh,	19.74	1.44	161	1371
Corn Silage.....	N. Carolina	33.95	1.29	144	2634
Cottonseed hulls.....	Clemson,	25	1.5	153	1786
Corn Silage.....	S. Carolina	40	2.18	222.36	1684
Cottonseed hulls.....	Manhattan,	22.22	.87	48.54	2555.3
Corn Silage.....	Kansas	71.13	2.50	139.79	2845.2
Cottonseed hulls.....	College Station,	27.87	1.98	236	1405.4
Silage.....	Texas	47.57	2.03	242	2339.0
Cottonseed hulls.....	College Station,	28.4	2.61	362.8	1081.3
Silage.....	Texas	50.9	2.29	318.5	2217.9
Cottonseed meal.....	Lafayette,	2.29	2.29	342.8	100
Soybeans.....	Indiana	2.28	2.51	376.7	91
Cottonseed meal.....	Auburn,	5.	1.55	185.5	327
Velvet Beans.....	Alabama	10.6	1.6	190.3	670
Cottonseed meal.....	State College,	3.69	1.74	271	213
Shelled Corn.....	Mississippi	8.78	1.8	280	489

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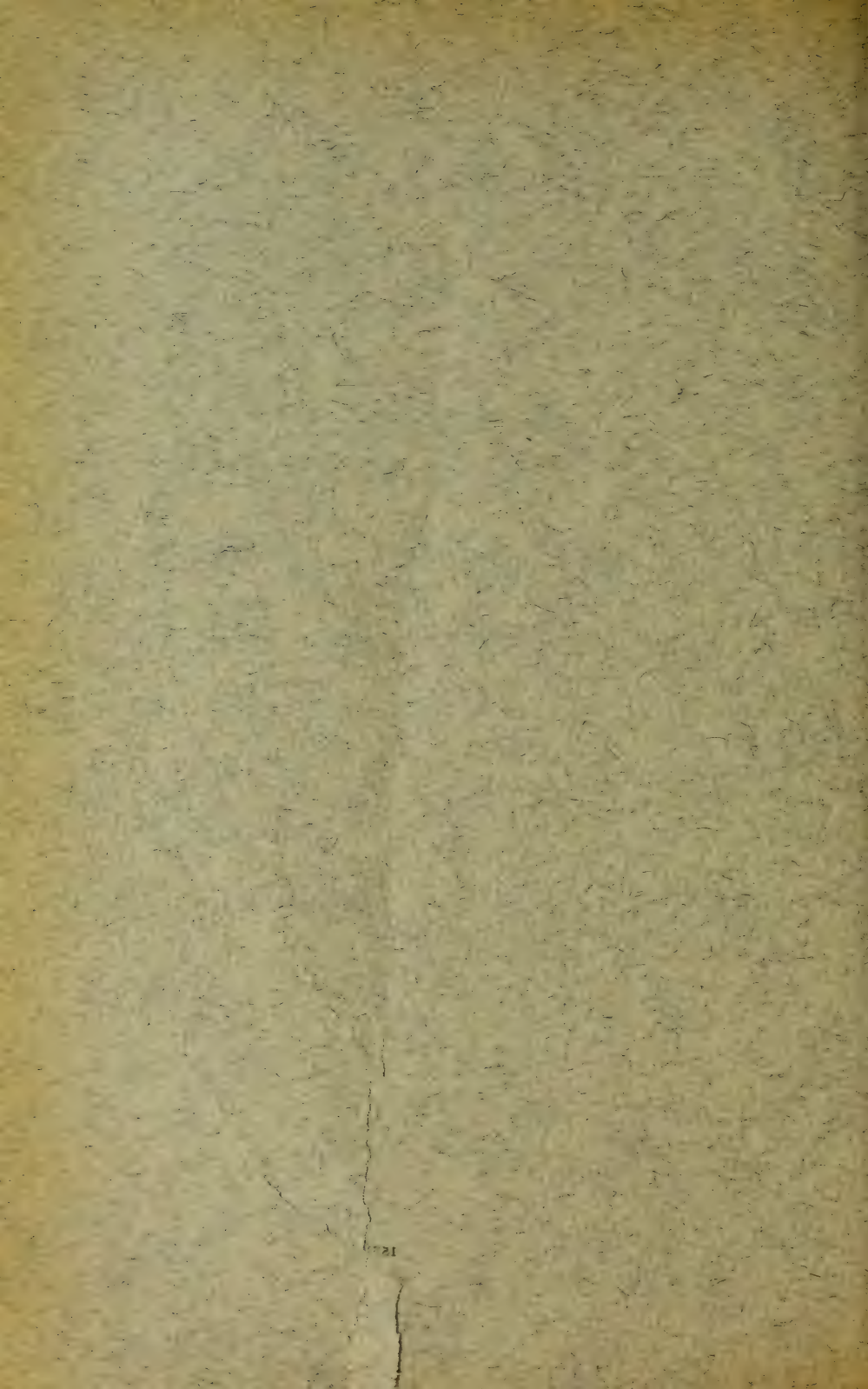
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Occupations
OF
Sons and Daughters of Mississippi
Cotton Farmers

BY
DOROTHY DICKINS

Mississippi Agricultural Experiment Station
State College, Mississippi

J. R. RICKS, Director



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Occupations of Sons and Daughters of Mississippi Cotton Farmers

BY

DOROTHY DICKINS

CHAPTER I.

INTRODUCTION

In 1930 there were 312,663 farms in Mississippi and cotton was grown on 92 percent of them.¹ It was the main cash crop of the majority of farmers; the only cash crop of many. A little over one-half of the native white people living on these farms were 19 years of age or under.² What happens to this large group of young people after they leave school? Where do they find employment—on farms, in towns, or in cities? What types of occupations do they pursue—professional service, homemaking, salesmanship, farming, or common labor? To what extent do they move from occupation to occupation? What proportion are farming full-time, are farming part-time? What percentage are engaged in occupations off the farm? What are some of the conditions possibly related to the occupational situation? How many are unable to carry on normal occupational careers? What can the farm family do to bring about a better occupational situation for its sons and daughters? What can the state do? These are the questions with which this study will be concerned.

Home Economics has long been interested in the welfare of the farm family. Home economists have studied and are now studying how the farm family can be fed more adequately, how the farm home can be made more comfortable, and how the members of the farm family can be clothed more becomingly. In recent years, they have devoted much of their attention to young children living in farm homes. This investigation is an attempt to study the children reared in farm homes after they are grown and are trying to make a place of their own in the world.

For a number of years rural sociologists have been studying the migration of farm youth to the city made possible by the progress of science and invention.³ The emphasis in most of these investigations has been upon migration and its effect upon the rural population. In this study the emphasis

¹U. S. Bureau of the Census **Fifteenth Census of the United States (1930)**, Agriculture, Mississippi, p. 39. However, only 129,775 of these farms were operated by white men, with which this study is especially concerned.

²U. S. Bureau of the Census **Fifteenth Census of the United States (1930)**, Population, Mississippi, p. 7.

³Among such studies are:

W. A. Anderson, **Mobility of Rural Families II**, Cornell University Agricultural Experiment Station, Bulletin 623 (Ithaca, 1935).

W. A. Anderson and C. P. Loomis, **Migration Among Sons and Daughters of White Farmers in Wake County, North Carolina**, North Carolina Agricultural Experiment Station, Bulletin 275 (Raleigh, 1930).

P. G. Beck and C. E. Lively, **Movement of Open Country Population in Ohio**, Ohio Agricultural Experiment Station, Bulletin 489 (Wooster, 1931).

J. L. Hypes, Victor A. Rapport and Eileen M. Kennedy, **Connecticut Rural Youths and Farming Occupations**, Storrs Agricultural Experiment Station, Bulletin 182 (Storrs, 1932).

E. C. Young, **The Movement of Farm Population**, Cornell University Agricultural Station, Bulletin 426 (Ithaca, 1924).

will be upon the occupations that have been and are now being pursued by farm-reared youth.

All the sociological investigations, however, have devoted some attention to occupations pursued by farm-reared youth. The two studies which perhaps give most attention to the occupations followed by sons and daughters of farmers are the Ohio and Connecticut studies. However, since the purpose of these studies was different from this study, the method of sampling was different. In these other studies the sample was random, while in this study the sample was controlled. Certain eligibility requirements were set up. An equal number of owner and tenant families were selected. A controlled sample was chosen in order to reduce the number of variables and to increase the number of families of a particular type, thus making it possible to apply the findings to similar groups in other areas.

So far as is known, this is the first study made of the occupations of sons and daughters of cotton farmers. Yet, the occupational situation of sons and daughters of cotton farmers and the factors underlying it is not just a problem of the Hillside community or of Greene County, or of the State of Mississippi. It is a problem of all cotton-growing states, or of the South as a whole. Since agriculture is the main occupation in Mississippi and cotton the main cash crop, this study should be of special interest to the people of the state, as well as those determining its policies.

CHAPTER II.

METHODS AND SCOPE OF THE STUDY

The Preliminary Study

Before this investigation was finally planned, a preliminary study was made for the purpose of: (1) testing the schedule; (2) determining the technique to use in collecting and classifying the data; and (3) guiding the selection of the group to be studied.¹ In this preliminary study there were included 155 sons and daughters 19 to 34 years of age² from 60 families.³ Data concerning these individuals were obtained by means of personal interviews with the parental families and by means of questionnaires from the sons and daughters.⁴

The information obtained from these two sources showed the need of certain changes in the schedule and plan for conducting the study. The desirability of change was especially indicated from the questionnaires returned by the sons and daughters. One of the main facts which these questionnaires revealed was the need for more careful questioning of the parental family. Such procedure was especially essential in this study, one in which the time element entered so prominently.

Other changes shown desirable were in the source of obtaining and in the method of classifying the data. The discrepancy in the replies of the family

¹A copy of the preliminary schedule will be found in the Appendix, pp. 119-122.

²This age group was chosen for two reasons: (1) the data would for the most part be obtained from the mother. The older the children the less accurate would be her information; (2) including sons older than 33 years would have brought in a number of World War veterans. War service might counteract other influences as far as occupations were concerned.

³In this investigation, the term "family" will mean the father-mother-child group including step-parents, step-children, and adopted children. There was, however, only one adopted child—a young daughter.

⁴The questionnaire sent to these young people contained a few of the questions which had been asked the parental family—questions which the child could supposedly answer as well or better than the parents; also questions which the family might hesitate to answer. Fifty per cent of the sons and daughters returned the questionnaires. These replies were used in testing the schedule and the procedure in the interview. A copy of the questionnaire will be found in the Appendix, pp. 116-117.

as to the date of leaving school was for example so great that it was decided to consult the school records where available. Education groups were changed from seventh grade and under to eighth grade and under as most of the discrepancies found in the information obtained from the family and child were on whether the son or daughter was in the seventh or eighth grade when he left school.

The preliminary study served not only to test the schedule and determine the technique to use in collecting and classifying the data but also served as a guide in the selection of the group to be studied. As previously stated, the preliminary study was limited to the sons and daughters of farmers in the age group of 19 to 34 years. Other qualifications which preliminary testing showed to be desirable were: (a) that their parents must have been reared on a farm and must have lived on a Mississippi farm located in unincorporated territory at the time they were in public school; (b) that their father's main occupation must have been farming and his main cash crop, cotton;⁵ (c) that sons and daughters must **not** have been enrolled in public or preparatory schools, colleges or vocational schools at the time of the study.⁶

Introducing these qualifications, preliminary testing revealed would not limit greatly the number of cases available and would have the advantage of reducing the variables involved. On the other hand it made clear cut comparisons with other studies of farm youth impossible, for in these other studies all the children of all the families in a given area were included.

Choice of the Counties

The study was confined to five counties: Jefferson Davis, Lauderdale, Sunflower, Tate, and Webster. In each of these counties the principal cash crop is cotton.⁷ According to a study made from census data by L. E. Long and M. A. Crosby, the cotton crop in 1929 accounted for approximately 83 per cent of the gross value of all crops in Jefferson Davis County; 53 per cent in Lauderdale County; 78 per cent in Sunflower County; 68 per cent in Tate County; and 53 per cent in Webster County.⁸ Since cotton is strictly a money crop and most of the other crops are feed and food crops grown for home use and not for sale, the percentage of cash income from cotton is even greater than the foregoing figures would indicate. Even with a reduced acreage of cotton in 1933 and 1934, it is safe to assume that cotton is still the main money crop of these counties.

While similarity was sought in one factor—main cash crop—diversity was sought in four factors: the farm situation, the school situation, the agricultural extension program, and the nearness to a city. Studies made by the National Resources Board in 1934 indicate that even though the main cash crop of the five counties is the same, the farm situation in the five counties is

⁵Children whose father's main occupation at the time of the study was farm manager or farm wage hand were not included. By main occupation is meant the occupation in which the greatest time is spent.

⁶The majority of tabulations to be used in the report dated from the time of leaving school, the usual time of starting an occupational career. The definition of farming sons and daughters could hardly have been made to include those who were taking a business course for the purpose of leaving the farm or those attending college with the idea of becoming teachers, yet in most cases they were supported in part, by the farm.

⁷Records from 52 families were secured in De Soto County. It was decided, however, to substitute Tate for De Soto County, as one borderline county, Lauderdale, had already been included. In borderline counties quite a number of otherwise available families have to be excluded because they have farmed part of the time in another state. Then, too, in De Soto County farmers carry on dairying rather extensively and this is a study of cotton farmers' children. Some case study material obtained from families of De Soto County, however, is used in this report.

⁸L. E. Long and M. A. Crosby, *Types of Farming in Mississippi*. Unpublished report.

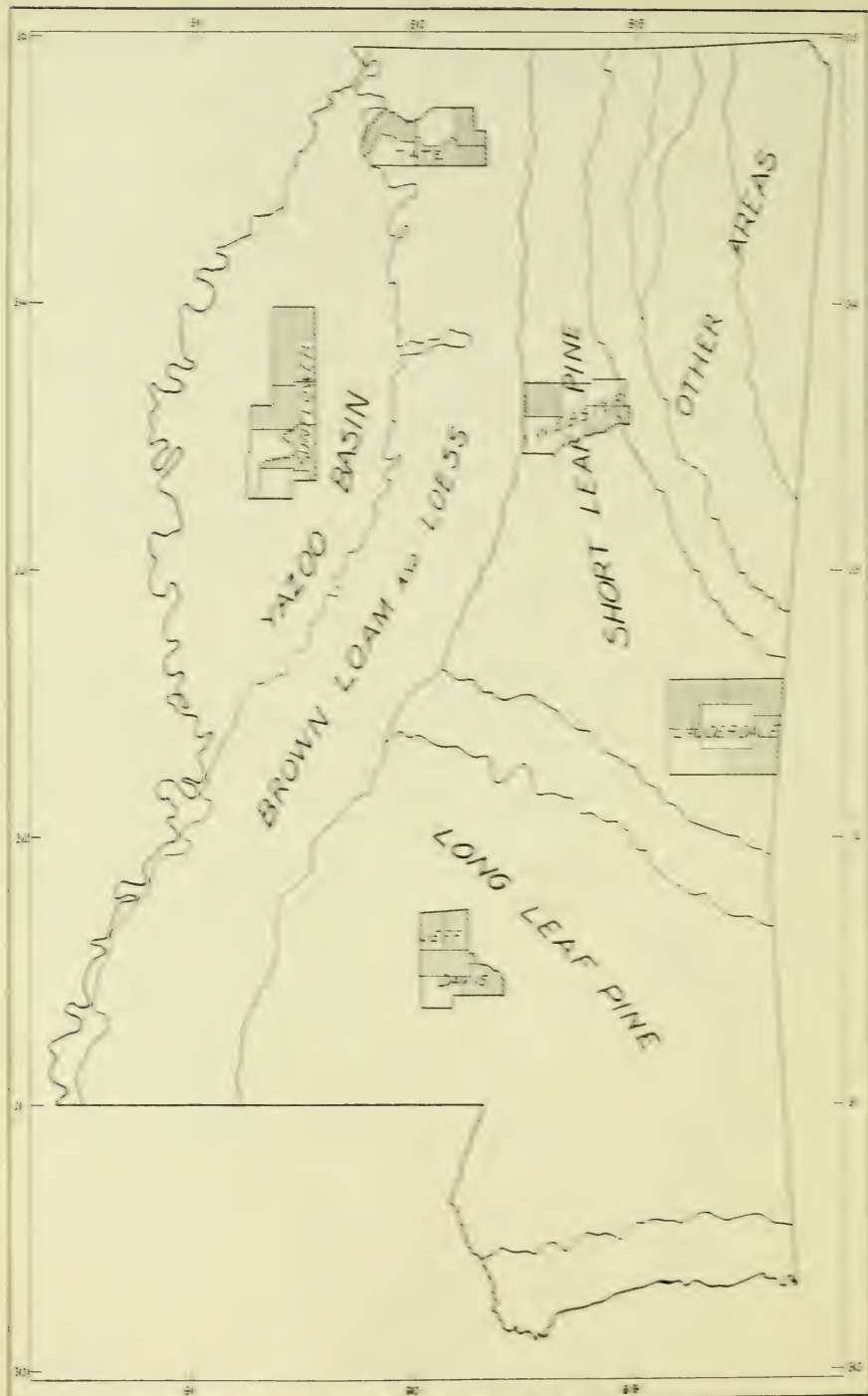


Figure 1. Map of Mississippi Showing the Counties, Seats and Soil Areas in Which the Study Was Made.

not the same.⁹ According to their studies, there is a special need in Jefferson Davis County for industry to supplement farming. In Lauderdale County the farms are as a rule too small to provide an adequate living standard and maintain soil fertility. Tate County has the problem of insufficient capital. A number of large plantations are heavily mortgaged. A substantial part of Webster County is submarginal. Sunflower County, unlike the other four, seemed to have no striking general problem in agriculture.

To understand the farm situation in the five counties, one needs to know more than the main problem of each. Such detailed information as type of soil, value of the farm property and of the crops, color and tenure of the population that farms the land (whether the operators are negroes or whites, owners or tenants)—these are facts which are also necessary for getting a picture of the farm situation in these counties.

The location of the counties in which the study was made is as follows: Sunflower County is in the Yazoo Basin alluvial soil area; Tate County is in the Brown Loam soil area; Webster and Lauderdale Counties are in the Short Leaf Pine Soil area; and Jefferson Davis County is in the Long Leaf Pine soil area. As may be noted, the counties are widely scattered over the state. (Figure 1).

The value of the farm property and of the crops varied widely in the five counties (Table 1). The values of farm property were about 7 times as great in Sunflower County as in Webster County; the values of crops about 6 times as great in Sunflower County as in Webster County.

Table 1. Value Per Acre in Farms of Farm Property and of Crops, Vegetables, and Farm Gardens in Five Counties Studied and in State^a

Area	Value of Farm property per acre	Value of crops, vegetables, and farm gardens per acre
	Dollars	Dollars
Jefferson Davis County.....	25	12
Lauderdale County	27	10
Sunflower County	100	50
Tate County	23	14
Webster County	14	8
Average of five counties.....	38	19
Mississippi	33	16

^aU. S. Bureau of the Census, **Fifteenth Census of the United States, (1930), Agriculture**; Mississippi, pp. 24-32.

About 80 per cent of the farm operators of Webster County were white people; about 20 per cent, negroes (Table 2). The proportion of whites to negroes in Sunflower County was exactly the reverse, there being 80 per cent

Table 2. Color of Farm Operators in Five Counties Studied and in State^a

Area	Percentage distribution of farm operators		
	White	Colored	Total
Jefferson Davis County.....	41	59	100.00
Lauderdale County	54	46	100.00
Sunflower County	21	79	100.00
Tate County	34	66	100.00
Webster County	81	19	100.00
Average of 5 counties	46	54	100.00
Mississippi	44	56	100.00

^aU. S. Bureau of the Census, **Fifteenth Census of the United States (1930), Agriculture**; Mississippi, pp. 6-12.

⁹Problem Area Map with Supplemental Report, Land Utilization Division Resettlement Administration, Mississippi, 1936.

negroes and 20 per cent whites.¹⁰ Tate County also had a high proportion of negroes (66 per cent).

Tenancy was greatest in Sunflower County and least in Webster County (Table 3). The usual method of farming in Sunflower County is the plantation system in which much of the cotton is grown by croppers. This method is also used to a large extent in Tate County, thus explaining the high percentage of tenancy in these two counties. The two principal reasons for this coincidence between tenancy and the plantation system is that only highly producing land may be retained as a profitable investment and that because of the high initial payments fewer people can afford to own land in highly producing areas.

Table 3. Tenure of Farm Operators in Five Counties Studied and in State¹

Area	Percentage distribution of farm operators		
	Owners	Tenants	Total
Jefferson Davis County	43	57	100.0
Lauderdale County	50	50	100.0
Sunflower County	4	96	100.0
Tate County	18	82	100.0
Webster County	51	49	100.0
Average of 5 Counties	30	67	100.0
Mississippi	28	72	100.0

¹U. S. Bureau of the Census, Fifteenth Census of the United States (1930), Agriculture; Mississippi, pp. 6-12.

Not only was diversity of situation sought as to the farm situation, but also as to the school situation. Counties were sought which varied as to the number and types of schools and to the average expenditure per white school pupil. In 1929-30, there were 14 Smith-Hughes high schools and three county agricultural high schools in the five counties of the study.¹¹ There were three Smith-Hughes high schools and one county agricultural high school in Tate County; four Smith-Hughes high schools and one county agricultural high school in Sunflower County; one county agricultural high school in Webster County (two "line" schools were Smith-Hughes); four Smith-Hughes high schools in Lauderdale County; and three Smith-Hughes high schools in Jefferson Davis County. Tate, Sunflower and Webster Counties had junior colleges. The colleges in the first two counties were publicly supported; in the latter the college was privately supported.

No complete and accurate information is available concerning the amount of money spent per white pupil in the various counties of Mississippi; however, there are data available from which a rough estimate can be made.¹² Such an estimate indicated that in 1929 expenditures per white child enrolled were somewhat greater in Sunflower and Tate Counties in which value of crops was greater. It would, therefore, seem that the educational situation was somewhat better for children in Sunflower and Tate Counties than in the other three counties.

Counties were selected to show contrasting conditions not only as to the farm and the school situation, but also as to the agricultural extension program. Due to the fact that each county must supplement Smith-Lever funds if it would have agricultural extension work, the program has varied in the

¹⁰The words "negro" and "colored" are used interchangeably, for they are synonymous terms in Mississippi.

¹¹F. J. Hubbard, "Vocational Education in Mississippi", Seventh Biennial Report, Bulletin 66, 1931, pp. 53-55.

¹²W. F. Bond, Biennial Report and Recommendations of the State Superintendent of Public Education, 1929-30 and 1930-31, Mississippi Department of Education (1930), pp. 84-114.

M. E. Moffitt, Twenty Years of Progress of Public Education in Mississippi, Mississippi Department of Education, Research Bulletin 1, (1931), pp. 163-175, 205-215.

respective counties. Using length of program as a criterion, the agricultural extension program of Lauderdale, Sunflower, and Jefferson Davis Counties might be termed good; that of Webster County fair; and that of Tate County poor. Using the same criterion, the home demonstration program of Lauderdale and Sunflower Counties might be classed as good; that of Tate County as fair; and the programs of Jefferson Davis and Webster Counties as poor.

As a final consideration in selecting the counties, diversity in respect to urbanization was sought. Mississippi is a rural state having only 13 cities of 10,000 or more inhabitants, and only 33 cities of 2500 or more inhabitants; hence great variation in this respect was not possible.¹³ Lauderdale County is the only county in the study which had a city of over 10,000 inhabitants. There are two towns in the five counties with a population of 2500 inhabitants or over; namely, Meridian and Indianola.

Senatobia, the county seat of Tate County, is, however, less than 40 miles from Memphis, Tennessee, one of the largest cities in the South. During the past fifteen years, Memphis has grown from a city of 125,000 inhabitants to 252,143 inhabitants. The Secretary of the Chamber of Commerce of this city writes, "While a great many of the new citizens have been absorbed from the rural sections, the majority of the populative acquisition has come from other centers of America. The rural people who have come in do not seem to get connected with any particular industry, but take any sort of work they are able to find. We find a large number working as street car motormen and conductors; others work in various factories here in the city while others become connected with the shipping industry."

Selection of the Sample in the County

The following procedure was used in selecting the sample area in each county. The families in the southeast beat of each county were visited until records from 50 owner and 50 tenant families meeting the qualifications of the study were secured.¹⁴ The families away from home were revisited until found at home. If there were not 50 owner and 50 tenant families fulfilling the requirements of the study living in the southeast beat, the northwest beat was then visited, after that the northeast beat. In Jefferson Davis County four beats had to be visited to secure sufficient records from tenant families. In some cases it was difficult to decide which was the southeast or northwest beat. The beat with the most territory in the southeast or northwest was chosen.¹⁵

A list of the communities in each beat was secured from the tax assessor's office. One community from the southeast beat was selected at random. This community was completely covered. If the community first selected was

Table 4. Number of Records Secured per Beat from Owner and from Tenant Families.

County	Owners					Tenants				
	S. E.	N. W.	N. E.	Central	Total	S. E.	N. W.	N. E.	Central	Total
	beat	beat	beat	beat		beat	beat	beat	beat	
Jefferson Davis	50	—	—	—	50	20	17	8	5	50
Lauderdale	50	—	—	—	50	20	15	15	—	50
Sunflower	9	29	12	—	50	28	22	—	—	50
Tate	21	27	2	—	50	22	20	8	—	50
Webster	50	—	—	—	50	30	20	—	—	50
Total	180	56	14	—	250	120	94	31	5	250

¹³U. S. Bureau of the Census, **Fifteenth Census of the United States** (1930), Population, 1, pp. 593-95.

¹⁴Each county in Mississippi is divided into five beats, or voting precincts.

¹⁵A study of values of farm lands and buildings per acre indicates that values were slightly greater on the areas in which Sunflower and Tate county families lived and slightly less on the areas in which Lauderdale and Jefferson Davis county families lived than for the county as a whole. U. S. Bureau of the Census **Fifteenth census of the United States**, (1930), Agriculture, Mississippi, Number of Farms, Farm Acreage, and Specified Farm Values by Minor Civil Divisions, pp. 7-11.

found to be above the average in general economic conditions for that beat, then the second community chosen was one below the average or vice versa. This procedure was followed until 50 owner and 50 tenant families fulfilling the requirements of the study had been found.

As is indicated in Table 4, more difficulty was encountered in securing records of tenants with grown children than of owners with grown children. There are two explanations for this. In the first place, 55 percent of the white owner men heads in the State are 45 years and over; only 29 percent of the white tenant men heads are 45 years and over.¹⁶ In the past it has been relatively easy for a farmer to become a landowner in this state. Opportunities for attaining ownership of land were given. The price of cotton was high with no limit on production. The typical white farm family of Mississippi with children 19 years of age and over is, therefore, an owner family. The other explanation for difficulty in securing tenant-family records is that proportionally more tenant than owner families were ineligible due to having lived in other states or having engaged in an occupation other than farming since their children had reached school age.

Every attempt was made to include all eligible families within the area surveyed. Each family was questioned about other families in the neighborhood. Many families not meeting all the requirements of the study were inadvertently visited. In some cases complete records were taken, as it was thought that such records might be of use for comparative purposes. Some of the homes visited could not be reached except on foot. In a few instances, a two or three mile walk through woods or over an impassable muddy road was necessary to reach a family or a group of families. In spite of the painstaking effort made to include all eligible families, a few may possibly have been missed, although in several cases the investigator went to the extreme of interviewing sick persons. In the majority of cases when there was sickness, there were several members at home, at least one of whom was willing to give the information.

Families not at home were revisited until found at home. Howe and Waite found that city families away from home were smaller and more prosperous; that is, that there is a selective factor that causes city families to be away from home.¹⁷ Though this might not necessarily be true of rural families, it was thought that, in view of these findings, it would be undesirable to omit families not at home on the first visit. Families, it was found, could be revisited at very little extra expenditure of money and effort.

Only 40 families in this study were not found at home on the first visit. There are a number of factors responsible for finding such a high percentage at home on the first visit. In the first place the year of 1933 was a year of business depression. The majority of families had no means of conveyance, that is they were forced to remain in or near the home. Then the families included in the study were large families. There was an average of 4.94 members per family living at home in the 500 families included in the study.¹⁸ The larger the family the more likely one would be to find some one at home who could give the information.

What difference would it have made had the 40 families who were not at home on the first visit been omitted entirely from this study? Would smaller

¹⁶U. S. Bureau of the Census, *Fifteenth Census of the United States (1930)*, Population, VI. Families, p. 706.

¹⁷C. B. Howe and W. C. Waite, *The Consumption of Dairy Products in Seven Metropolitan Cities of New Jersey*, New Jersey Agricultural Experiment Station, Mimeographed Report, (New Brunswick, 1932), p. 102.

¹⁸It is impossible to estimate the proportion of the total number of white farm families with children 19 years and over which the sample contained. The 1930 census showed about 50,000 white men on farms 45 years and over. However, many of these had no children. Many who had children in this age group were ineligible for the study.

and more prosperous families have been missed as was the case in Howe's and Waite's study of city families? Of the 40 families away from home on the first visit, 28 were landowners. Their average size was about 7 living members. The average size of families visited only once was 8 living members.

Although families visited once and those visited more than once show significant differences both in tenure and size of family, when the families who were visited only once are compared with all the families visited, these differences are small; due, of course, to the fact that the number of families not at home on the first visit was very small—too small to affect the final averages greatly. Revisiting families not found at home would not have been necessary in the case of this study.

Collection of the Data

The data for the study were collected by personal interviews with the parental family, using the schedule evolved by preliminary testing.¹⁹ All schedules were filled out by one person, the investigator. It took from the first of January, 1934, to the last of June, 1934, to complete schedule taking. The schedules used in the preliminary study were filled out in the fall of 1933. Thus the investigator had ample opportunity for comparing the advantages and disadvantages of various periods of the year for securing records. From the standpoint of finding the family at home and with plenty of leisure time for giving the information, winter was the best time.

The families in this study were not notified ahead of time of the interview. It would have taken almost as much effort to secure an accurate mailing list of families fulfilling the requirements of the study as it did to secure the schedules. Not notifying the family ahead of time had the advantage in that the family had no opportunity of getting embarrassed over the proposed interview or of thinking up answers which would possibly sound good. On the other hand, a little previous meditation would undoubtedly have yielded more accurate data. Several said, "Why, I haven't thought about this in so long! If I only had had the questions ahead of time to think over!"

The Accuracy of the Data

Some means by which the accuracy of the information obtained from the parental family could be gaged was deemed essential. Without such a measure interpretation of the data would be difficult. What would an association between schooling and occupation, for instance, mean without it? How could one be sure whether there was actually an association?

As has been stated before, questionnaires were sent to the sons and daughters in the preliminary study for the purpose of testing the technique of collecting the data. Fifty per cent of the sons and daughters to whom these questionnaires were sent returned them. The group returning them seemed to be representative. It was, therefore, decided to use the replies of the sons and daughters as a check on the accuracy of the information obtained from the parental family. Thus the sons and daughters included in the study were asked the same questions as were asked the parental family.²⁰ Five hundred and seven of the questionnaires were returned. In the analysis of the data obtained from the parental family found in subsequent chapters, their agreement with the statements obtained from the child is taken into consideration and discrepancies pointed out. A full discussion of the relative agreement of the data secured from the two sources will be found in Appendix A.²¹

¹⁹The schedule used will be found in the Appendix, pp. 122-126.

²⁰See Appendix C, pp. 117-119 for the questionnaires sent to the sons and daughters.

²¹See Appendix A, pp. 107-116.

CHAPTER III.

GENERAL OCCUPATIONAL DISTRIBUTION OF ALL SONS AND DAUGHTERS 19 TO 34 YEARS OF AGE

There were 1567 sons and daughters 19 to 34 years of age in the 500 families included in the investigation or an average of 3.13 per family. The number of sons and of daughters in these families was about the same. The

Table 5. Occupational Distribution of All Sons and Daughters 19 to 34 Years of Age.

Occupation	Number	Percent
Sons	799	51.0
Farming	504	32.1
Non-farming	188	12.0
Part-time farming	70	4.5
Students	29	1.9
Incapacitated	8	.5
Daughters	768	49.0
Farming	489	31.2
Non-farming	205	13.1
Part-time farming	47	3.0
Students	22	1.4
Incapacitated	5	.3
Total	1567	100.0

proportion engaged in the varying types of work differed very little; about two-thirds of each group being engaged in farming. However, among those classed in farm, non-farm and part-time farm work, were a number who were handicapped, some who were widowed or divorced and some who did not fulfill the requirements of the study. The first two groups will not be included in the analysis of the three occupational classes found in subsequent chapters but will be segregated for special study. Those who did not fulfill the requirements of the study will not be considered after this chapter. In other words, the main concern of this study will be with the sons and daughters, who fulfill its requirements of eligibility, are engaged in agricultural or non-agricultural activities or both, are single or married, and normal physically and mentally. Before proceeding with this discussion it seems well, however, to sketch briefly some of the characteristics of the groups who will be excluded from the main part of the study as well as give a general picture of the group who will be included.

The Handicapped Group

No question concerning the physical and mental handicaps of the sons and daughters was included in the preliminary study but this information came out in the course of the interview. In some cases these handicaps seemed to make practically no difference in the occupational careers of the sons and daughters. In other cases they seemed to make a vast difference. It was consequently decided to include a question about handicaps in the schedule and to analyze the handicapped separately.

It was often difficult to determine whether or not a son or daughter belonged in the handicapped category. Frequently when a family was asked if one of their children had any handicaps, they would answer in the affirmative with statements similar to the following: "I was never strong"; or "J is very nervous"; or "K has weak eyes." Such individuals were, however, not placed in the handicapped group. Often remarks like the foregoing were merely rationalizations on the part of the family to explain why Johnnie and Susie were still around home doing very little to earn their keep.¹

¹On the other hand, a few parents, because of sensitiveness, may have failed to report a handicap of their child.

Certain individuals might be termed "border line" cases. Cases like the following come in this category. "L is very nervous. The doctors say he may go into epilepsy some day;" "M has one eye that she can't see much through"; "N's right hand is not so strong." Such individuals were, however, not classified as handicapped in this study, unless their occupational lives appeared to be abnormal. One could not put in the category of physically or mentally handicapped, individuals whose handicaps seemed no more definite than these general statements seemed to indicate.² The fact that the handicapped individual usually lived at home and was often present at the interview was in a few cases a help to the investigator in making the classification. The group in this category included three per cent of the sons and daughters 19 to 34 years of age in the 500 farm families in the study.³

Table 6. Main Occupations of Physically and Mentally Handicapped Sons and Daughters.

Main Occupation	Sons Number	Daughters Number	Total Number
Farming	22	10	32
Non-farming	4	2	6
Incapacitated	8	5	13
Total	34	17	51

About three-fourths of the handicapped sons and daughters could at least assume some occupational duty. As may be noted, the majority of these were farming (Table 6). Only one-fourth were totally incapacitated. A number of those with permanent handicaps were apparently living normal occupational lives. Of course, what the situation would have been had the individual not had the handicap is not known.

There were more handicapped sons than daughters. There are undoubtedly a number of explanations for this. Sons are more frequently forced into the occupational world, and their handicaps are thus brought to light and exaggerated. Such occupations as followed by the men in this study were more hazardous than the occupations followed by the women. Farming and truck driving are particularly hazardous. In the third place, men hunt and drink more than do women and are, therefore, more likely to meet with mishaps.

The Widowed and Divorced

Another group of sons and daughters not included in the main occupational analysis are the widowed and divorced. Unwed mothers, and daughters married to invalids dependent on the parental family or society for support, were also included in this category.⁴ It was thought that these two groups belonged in this category rather than with the single girls and married women, for in a way their situation was similar. In fact, it was often worse, for the daughter with an invalid husband had the added burden of an invalid while the unwed mother, the added burden of social stigma.

Table 7. Main Occupations of the Widowed and Divorced Sons and Daughters.

Main Occupation	Sons Number	Daughters Number	Total Number
Farming	9	16	25
Non-farming	5	4	9
Total	14	20	34

²The physically or mentally handicapped included, therefore, two groups: (1) those permanently physically or mentally handicapped; (2) those unable to carry on normal occupational lives because of a physical or mental defect.

³A list of those classified as handicapped will be found in the Appendix, p. 127.

⁴Daughters with incapacitated husbands having an income were of course not classified in this group but as "Non-farming Daughters". Those whose husbands had an occupation in addition to a regular source of income (as pensions, rents and interest) were classified according to the occupation of their husband.

The widowed or divorced sons and daughters were somewhat less likely to be engaged in farm work than were the handicapped. This would be expected for more handicapped children live in the parental home and farming is about the only occupation open to those remaining on the parental farm.

Sons and Daughters not Fulfilling the Requirements of the Study

Table 8. Main Occupations of the Sons and Daughters Not Fulfilling the Requirements of the Study.

Main Occupation	Sons Number	Daughters Number	Total Number
Farming	10	16	26
Non-farming	6	3	9
Total	16	19	35

It is interesting to note that the group not fulfilling the requirements of the study differed very little in type of occupations pursued from the eligible group. That the difference was not greater is undoubtedly due to the fact that the individuals not fulfilling the requirements of the study were from families who had one or more children who did fulfill these requirements.⁵ Otherwise, the family would have been excluded entirely. The parental families of these children were all farm families, some of whom had ventured to farm lands in Florida, Arkansas, Alabama, or Oklahoma, or to town or city hoping to better their lot. On not being able to do so, they had returned to a Mississippi farm. Others had secured a job in Memphis or Meridian; but after counting the cost of living in the city, had returned promptly to the country.

Sons and Daughters in School or College

The 51 students were also excluded from the main analysis for reasons which have been stated. Thirty-one were public school students. Twenty-one of these were 19 years of age; 5 were 20 years of age; and 5 were 21 years of age. More boys than girls were still in public school. Boys more frequently than girls were kept at home for cultivation of cotton. They, therefore, fail to make the progress that girls do in school. Only 13 of the 19 to 34 year old group were in college (6 sons and 7 daughters) at the time this study was made. Eleven were in state-supported colleges. Twelve of the 13 in college were sons and daughters of land owners. One, the son of a tenant family, was at Mississippi State College. In addition to the 31 in public school and 13 in college, there were 7 who were taking vocational courses, including beauty culture, nurses' training, business, commercial baseball, and English.

Farming Sons and Daughters

There were in this study 468 farming sons. "Farming" sons included those whose main occupation was farming, either on their own or as farm assistants who were without secondary non-farm occupations⁶ or whose last known occupation was farming, even though at the time of the study they were unemployed, detained in prison, or following some unknown occupation.

As may be noted, (Table 9) only 3 per cent of the group who ordinarily farmed were unemployed. An unemployed farmer is a person who was formerly an owner, manager, tenant, or wage worker, but who had not been able to find land or any one to hire him and is dependent on society or his family for full or partial support. Those farming land on which they were allowed

⁵Of those not fulfilling the requirements of the study 15 had lived outside the state some time during their public school career. Thirteen had lived in town. The parental family's main source of income had come from non-farm work at some period during the school careers of 7 of the sons and daughters.

⁶A secondary occupation is the occupation in which one spends time regularly but less time than is spent in another occupation.

Table 9. Occupational Status of Farming Sons.

Tenure	Engaged in farming		Unem- ployed	In Prison	Occupation unknown	Total	
	Number	Per cent	Number	Number	Number	Number	Per cent
Farm operators	278	61.7	8	2	—	288	61.6
Owners	30	6.7	—	—	—	30	6.4
Managers	10	2.2	1	—	—	11	2.4
Tenants ^a	238	52.8	7	2	—	247	52.8
Farm laborers	173	38.3	4	2	1	180	38.4
Wage workers	77	17.1	4	2	1	84	17.1
Non-Cash assistants ...	96	21.2	—	—	—	96	20.5
Total	451	100.0	12	4	1	468	100.0

^aFollowing the census classification, sharecroppers were included in this group. However, they are really not farm operators. They are often classified by agricultural economists as tenant farm labor.

to plant everything except cotton were not classified as unemployed. Sons formerly employed in non-farm occupations temporarily at home until they could find employment (a year or less) were classified as in non-farm work.

Four of the sons were in prison; one in the county jail; two in the State penitentiary; and one in Atlanta, Georgia, in the Federal penitentiary. There was only one son whose occupation was unknown. In several instances it was difficult to determine in which category to place a son, as "occupation unknown" or as "unemployed." For instance, one mother stated, "My son has gone to South Mississippi to see if he can find work on a truck farm." This son had been a share cropper the year before but had been unable to obtain a farm. He was classified as unemployed. By some, the occupation of such an individual would have been classified as unknown, for the mother did not know exactly what her son was doing at the time of the interview.

Two-thirds of the sons engaged in farming at the time of the study were farm operators; the remainder were farm laborers. Very few, however, of the farm operators were owners.⁷ The majority of them were tenants. There were more non-cash assistants than wage workers. Some investigators would have doubtless classified the non-cash assistants or the 96 sons working at home without financial agreement as unemployed. However, labor, like other commodities, is subject to the law of supply and demand. If there were sufficient demand, most of these sons might leave home. Yet, even in such a prosperous year as 1923, many sons remained on the home farm in the capacity of non-cash assistants. There was undoubtedly a higher proportion of non-cash assistants on Mississippi farms in 1933 than in 1923. Granted that this is true, then which of the non-cash assistants at home now would be out for themselves under very favorable economic conditions? The son himself does not know what he would be doing under different circumstances. Either all or none of these sons must be counted as employed. Counting all as employed seemed the only possible solution of this problem.

⁷The definitions of the five tenure groups are as follows:

An owner—is a farmer who has title to the land he operates. (He lives on the land to which he has title.)

A manager—is a farmer receiving wages or a salary for supervision of farm tenants and wage workers.

A tenant—is a farmer who does not have title to the land he operates, (He does not hold title to the land on which he lives.)

A wage worker—is a farmer working for wages or a stated amount of the crop; that is, one bale of cotton, cotton from 5 acres. In the latter instance, it is often difficult to distinguish him from a tenant.

A non-cash assistant—is a farmer who works for his family or others without financial agreement. His position is analogous to that of a child, reimbursement depending on his bargaining power in the family or group. He may get more or less than the wage worker, depending on his bargaining power.

Table 10. Occupational Status of Farming Daughters.

Occupational classification	Number	Per cent
Farm housewives	336	74.2
Farm-home assistants	116	25.6
Wage workers	1	.2
Total	453	100.0

Farming daughters included the daughters who had no secondary non-farm occupations who were either actually engaged in farming or were dependent on their husbands' or their families' farms for support. There was only one woman who was farming under a definite financial agreement (Table 10). She was a wage worker, a woman of 32 years of age, who worked for a brother for "Government rent." Few white women in Mississippi actually operate farms or work as wage hands. Many farm, but they are usually assistants to husbands and fathers without definite cash compensations.

Three-fourths of the daughters classified as farming were wives of farmers (Table 10). The occupational status of the majority of daughters in this group was, therefore, set by the occupation of their husbands, seventy-five percent of whom were farm tenants, twenty-two percent owners and the re-

Table 11. Occupational Status of Farming Sons-in-Law.

Tenure	Engaged in farming		Unemployed		Total	
	Number	Per cent	Number	Number	Per cent	
Farm operator	317	97.0	9	326	97.0	
Owners	74	22.7	—	74	22.0	
Managers	3	.9	—	3	.9	
Tenants	240	73.4	9	249	74.1	
Farm laborers	10	3.0	—	10	3.0	
Wage workers	4	1.2	—	4	1.2	
Non-cash assistants	6	1.8	—	6	1.8	
Total	327	100.0	9	336	100.0	

mainder wage workers. This is quite different from the proportion of sons in the varying tenure groups.^a Farm sons however were a younger group, and consequently more were farm laborers and fewer were farm operators than in the case of the farm sons-in-law. About the same proportion of sons-in-law as sons were unemployed. There were no farming sons-in-law who were in prison or whose occupation was unknown.

One-fourth of the farming daughters were farm-home assistants or unmarried daughters assisting in the home of their parental families. Farm-home assistants were in a position somewhat similar to non-cash farm assistants. Both were non-gainful workers. However, the bargaining power of the non-cash farm assistant was greater. If he was dissatisfied with the arrangement, he could more easily find farm work elsewhere. Several instances where the son had exercised his bargaining power were encountered.

Mr. E. thought his son should not get any part of the crop made on his land. "As long as it is my land, then the crop is mine", he said. His son was very much dissatisfied with this lack of agreement. At the time of the study, the son had won the reluctant consent of his father to give him a small part of the crop he would help make during the coming year. F's father counted him as just one of the children; so F decided to leave home. His father gave him a "patch of cotton" all his own to keep him on the farm.

Non-cash farm assistantship might be thought of in one sense as a term of apprenticeship leading to becoming a farm operator, while farm-home assistantship as a term of apprenticeship leading to becoming a housewife; usually the wife of a farmer. Neither group is gainfully employed or unem-

^aTable 9, p. 19.

ployed. Their position is really analogous to that of a boy or girl taking a vocational course. However, unlike the term of apprenticeship in other fields, the term of apprenticeship in these fields might extend out indefinitely or be terminated abruptly, should the opportunity for entering a desired occupation present itself.

Non-farming Sons and Daughters

Next in size to the farming group were those in non-farm occupations.^a There were 173 sons in this group. It included those whose occupation was in a non-agricultural pursuit who were without a secondary farm occupation and those whose last occupation, or last known occupation, was in a non-agricultural pursuit, even though at the time of the study they were unemployed, detained in prison, or their occupation was unknown.

About 93 per cent of the sons in non-farm work were employed; twelve were unemployed. Sons formerly employed in non-agricultural occupations, temporarily at home until they could find employment (a year or less) were classified as unemployed non-farmers. Probably two illustrations of the method used in classifying might clarify the definition of unemployment used in this connection. G, a mechanic, had had no steady work for eight months. He had been at home most of the time and occasionally helped on the farm when the family needed him. However, during this period he had spent most of his time looking for work in his trade. G was classified as an unemployed non-farmer.

Sons and daughters who lost their non-farming positions and were forced to return to the farm, unlike G, generally engaged in farm or farm-home work shortly. Farming was nothing new to them, for the majority were farmers and farm assistants throughout their school days; and when they were thrown out of employment, they naturally reverted to their childhood work if circumstances permitted.

Family H is another good illustration of the methods of classification used. This family lived in town three years ago. Mr. H worked in a furniture factory and all of his children had non-farm work. One son was a messenger boy for a telegraph company. Another was a case fitter at a furniture factory. The factory failed and the family returned to the farm. For the past three years the former messenger boy had assisted his father on the farm; the former case fitter made a crop of his own. These sons, although they had had

Table 12. Occupational Status of Non-farming Sons.

Main occupation ^a	At time of the study					
	Engaged in non-farm pursuits		Unemployed	Unknown	Total	
	Number	Per cent	Number	Number	Number	Per cent
Salesman	17	10.6	1	—	18	10.4
Professional service	8	5.0	—	—	8	4.6
Clerical service	16	10.0	—	—	16	9.2
Machine and related trades	32	20.0	3	—	35	20.2
Domestic and personal service	4	2.5	—	—	4	2.3
Common labor	21	13.1	3	—	24	13.9
Proprietors and managers	16	10.0	1	—	17	9.8
Supervisory service	2	1.3	—	—	2	1.2
Drivers and carriers	17	10.6	—	—	17	9.8
Factory operatives and laborers	14	8.8	3	1	18	10.4
Soldiers, sailors, policemen, etc.	13	8.1	1	—	14	8.2
Total	160	100.0	12	1	173	100.0

^aClassification of occupation according to the "Character of Work." A description of each group in the classification is given in the Appendix pp. 126-127.

^aTable 5, p. 16.

non-farm experience and would probably return to town for a non-farm job, should a good one be available, were classified as farmers.¹⁰

The fact that the son or daughter of a farmer has an occupation as well as a home to return to undoubtedly means that for farmers' children unemployment does not connote exactly the same thing as it does for non-farmers' children. The home farm is rather an elastic affair. In an emergency, arrangements can usually be made to provide land for another son. There is, of course, a limit to which this can be done. Without a doubt many families in this study had reached the limit.

As may be noted, there were proportionately over twice as many non-farming as farming sons unemployed. Production of farm products did not decline as greatly during the depression as production of industrial products. However, production of farm products did decline to a greater extent than it ordinarily would have under similar conditions due to the reduction in acreage program of the A.A.A., and especially the cotton acreage reduction program. This resulted in the displacement of tenants to a certain extent; or, on farms where there were no tenants, in the farm's not being able to absorb the unemployed non-farm relatives to the degree that they otherwise could have done. That the displacement was not greater was due to the rules and regulations providing that the landlord must keep the same number of tenant families from year to year.

Non-farming daughters included the daughters whose main occupation was in some non-farm pursuit and who had no secondary farm occupation; and daughters with no secondary farm occupation who were dependent on their non-farming husbands for support. As is shown, 64 per cent of these daughters received their occupational status from their husbands (Table 13). Seventy, or 36 per cent, themselves had a gainful non-farm occupation. Twenty-seven of these were married women. The majority of the gainfully

Table 13. Number of Non-farm Daughters Deriving Occupational Status from Own and From Husband's Occupation.

Item	Number	Per cent
With non-farm occupations.....	70	36
Non-farm housewives	123	64
Total	193	100

employed daughters were in professional work, usually teaching (Table 14). Factory work, personal service (usually "beauty culture"), clerical service, and saleswork were the other types of occupations commonly followed.

Table 14. Occupational Status of Daughters with a Non-farm Occupation.

Main occupation	Engaged in non-farm pursuits		Total
	Number	Unemployed	
Professional service	26	5	31
Factory operative and laborer.....	11	—	11
Personal service	8	—	8
Clerical service	7	2	9
Supervisory service	1	—	1
Saleswoman	8	1	9
Proprietress	1	—	1
Total	62	8	70

Eight of the 70 daughters in non-farm occupations were unemployed. The majority of these were teachers. A high school graduate used to be able to get a teaching position in the rural districts of Mississippi. Now the schools demand college trained teachers. One will thus find quite a few teachers in

¹⁰This family was in the preliminary study.

the rural districts who, because of inadequate training, are unable to find schools. There are, also, a number of "would be" teachers, graduates of junior and senior colleges who, because of the lack of experience, have not been able to secure work. However, unemployed non-farm daughters included only daughters formerly employed in non-agricultural occupations, temporarily at home until they could find employment (a year or less).

What about the daughter who four or six years ago failed to find a school, and is now at home working on the farm and assisting her mother? Is she to be classified as an unemployed teacher? Certainly not! She could no more be classified as an unemployed teacher than a married sister, a former teacher, who had been away from the school room four or six years. Willingness to take a job should a good one be offered and unemployment are not the same thing.

It is interesting to note that the proportion of non-farm daughters who were unemployed is greater than that of sons—that the percentage of unemployed single daughters was greater than the percentage of unemployed married daughters. The number of married daughters with non-farm work was, however, too limited to make these findings altogether significant. The husbands of four of the 27 married daughters with non-farm occupations were unemployed. This was a much higher proportion of unemployed husbands than was found in the case of either the farm or non-farm husbands of daughters without gainful occupations. The fact that their husbands were unemployed was doubtless largely responsible for the wives' gainful occupation.

As is true of farm housewives without a main gainful occupation, so is it true of non-farm housewives without a main gainful occupation, their occupational status is set largely by that of their husbands. The majority of husbands following non-farm pursuits were salesmen, drivers and carriers, or in machine and related trades (Table 15). Only 11 per cent were proprietors and managers.

Table 15. Occupational Status of Non-farming Sons-in-law.

Main occupation	Engaged in non-farm pursuits		Unemployed	Unknown	Without occupation ^a		Total	
	Number	Per cent	Number	Number	Number	Number	Per cent	
Drivers and carriers.....	22	19.3	—	—	—	22	17.9	
Proprietors and managers.....	13	11.4	—	—	—	13	10.5	
Salesmen.....	14	12.3	1	1	—	16	13.0	
Clerical service.....	6	5.3	—	—	—	6	4.9	
Supervisory service.....	4	3.5	—	—	—	4	3.3	
Soldier, sailor, policemen, etc.....	5	4.4	—	1	—	6	4.9	
Machine and related trades.....	29	25.4	2	—	—	31	25.2	
Factory operative and laborer.....	6	5.3	2	—	—	8	6.5	
Professional service.....	5	4.4	1	—	—	6	4.9	
Common labor.....	7	6.1	—	—	—	7	5.7	
Personal service.....	3	2.6	—	—	—	3	2.4	
Income from property.....	—	—	—	—	1	1	.8	
Total.....	114	100.0	6	2	1	123	100.0	

^aDaughter married to this man excluded from analyses in Chapters VII, VIII, and IX, as were those classified by past occupation of husband.

The most striking differences in the occupations of the non-farm sons and sons-in-law were: (1) the much higher percentage of sons-in-law who were drivers and carriers; the transportation of goods from one point to another via truck and the upkeep of graveled roads, consisting mainly in driving scraping machines over the roads, provide much employment—main, secondary and supplementary¹¹—for rural men of Mississippi; (2) the greater proportion of sons than of sons-in-law doing common labor. This is due, of course, to the

¹¹A supplementary occupation is an occupation occasionally or irregularly followed.

fact that quite a few of the sons were in C.C.C. camps. Married men were not permitted to enlist.

A somewhat smaller proportion of non-farm sons-in-law than of non-farm sons were unemployed. It is difficult to account for this except by the fact that the sons-in-law were somewhat older and were probably better established in their occupations. There were two sons-in-law whose occupations were unknown and one who lived from investments.

Part-time Farming Sons and Daughters

After thoroughly studying the data obtained in the preliminary study, it was concluded that another occupational class must be introduced, a class which included the sons and daughters regularly engaged both in a farming and in a non-farming occupation, for it was apparent that this group differed in some respects from those regularly engaged in farm or non-farm pursuits. Thus, the part-time farming group was added.

Part-time farming sons, therefore, include the sons regularly engaged in both agricultural and non-agricultural work. The main occupation of nearly three-fourths of these sons was, however, farming (Table 16). The number of part-time farming sons was doubtless less than ordinary at the time of the study, for 1934 was a year of business depression. There were quite a number of families who spoke of their sons formerly having a regular secondary occupation, but of not having it at the time of the study.

Table 16. Main Occupations of Part-time Farming Sons

Main occupation	Number
Farmer	48
Driver and carrier	4
Supervisory service	2
Clerical service	2
Salesman	2
Machine and related trades	2
Common laborer	2
Professional service	1
Proprietor	1
Factory operative and laborer	1
Total	65

Part-time farming daughters included daughters with secondary non-farm occupations whose main occupations were those of farm homemakers or farm-home assistants, and daughters with no gainful occupation who were married to men regularly engaged both in farming and in non-farming occupations. In Table 17 is found the occupational classification of the 44 daughters in this group. As may be observed, 59 per cent of these daughters received their occupational status from their husbands. Forty-one per cent of the daughters themselves had a secondary non-farm occupation.

Secondary non-farm occupations of the housewives and farm-home assistants were largely "New Deal" occupations which at the time of the study required twenty hours a week or less. The most common of these were home visiting and school-lunch work.

Table 17. Occupational Classification of Part-time Farming Daughters

Occupational type	Number
Farm-homemaker with a secondary non-farm occupation	8
Farm-home assistant with a secondary non-farm occupation	10
Daughters married to men engaged both in a farming and non-farming occupation	26
Total	44

Of the 1396 sons and daughters qualifying for the vocational study, 88, or 6 per cent, had "work relief" jobs (Table 18). In addition to these, there were quite a number who received direct relief. Since this is a study of occupations, not unemployment, the latter information was not obtained. The percentage of sons and daughters with "work relief" was not high. However, the persons concerned were young; and young people were not as likely to receive "work relief" as older people, since they generally had fewer dependants. Then, too, "work relief" was not often given to two members of the same family. Many of the sons and daughters in the study were living at home and were classified by relief authorities as members of the parental family. In the third place, the majority of the group were farmers, an occupation in which it is possible to produce most of the necessities of life.

Table 18. New Deal Occupations Followed by Sons and Daughters Included in the Vocational Study.

"New Deal" Occupations	Sons Number	Daughters Number	Total Number
Main occupations	19	3	22
Clerical service	1	1	2
Professional service	—	2	2
Common labor (CCC Camp)	18	—	18
Secondary and supplementary occupations	42	24	66
Common labor	39	—	39
Sewing	—	6	6
Supervisory service	1	3	4
Professional service	2	11	13
Clerical service	—	1	1
Personal and domestic service	—	3	3
Total	61	27	88

In the six succeeding chapters a detailed analysis will be made of the sons and daughters fulfilling the requirements of the study classified according to their occupation. In Chapter X the physically and mentally handicapped and the widowed and divorced will be discussed. The 35 sons and daughters not fulfilling the requirements of the study and the 51 in school or college will not be considered further for reasons already stated.

CHAPTER IV.

THE RELATION OF AGE, EDUCATION, MARITAL STATUS, AND RESIDENCE TO OCCUPATION

One of the purposes of this investigation, as stated in the introductory chapter, was to analyze the type of occupations followed by the sons and daughters 19 to 34 years of age with reference to conditions possibly related to the occupational situation. In this chapter, age, formal education, marital status, and place of residence of the individuals concerned are the factors which will be considered.

Age

The methods used in selecting the individuals in this study resulted in the inclusion of more of the younger sons and daughters reared on Mississippi farms. About 40 per cent of the group were from 19-23 years of age; about 25 per cent were from 29-33 years of age. Naturally, this would be the case, for more parents of 32 or 33-year-old sons and daughters than of 19 or 20 year-old sons and daughters were dead. More are not maintaining a home. Children 29-33 years of age in this study were therefore more likely to be the oldest children of their families, less likely to be the youngest of their families.

The younger sons and daughters were more often found to be farming than to be following other occupations (Table 19). Many of the 19-23-year-old

Table 19. Age of Sons and Daughters Studied Classified According to Occupation.

Age groups	Number of sons				Number of daughters			
	Farming	Non- Part-time		Total	Farming	Non- Part-time		Total
		farming	farming			farming	farming	
19-23 years	218	37	13	268	208	59	17	284
24-28 years	172	75	24	271	153	72	15	240
29-33 years	78	61	28	167	92	62	12	166
Total	468	173	65	706	453	193	44	690
Percentage distribution								
19-23 years	81.3	13.8	4.9	100.0	73.2	20.8	6.0	100.0
24-28 years	68.4	27.7	8.9	100.0	63.8	30.0	6.2	100.0
29-33 years	46.7	36.5	16.8	100.0	55.4	37.3	7.3	100.0
Total	66.3	24.5	9.2	100.0	65.7	28.0	6.3	100.0

group were non-cash assistants, wage workers, and farm-home assistants, most of them having but recently left school.¹ Some of these will not remain in farming, as such an occupation serves for many as merely something to do until non-farm work or a non-farm husband is secured.² Another explanation for such a large percentage of the younger sons and daughters farming is that the majority have left school since the depression, and there have been fewer opportunities than usual of securing other kinds of work. This will be discussed further in Chapter VI.

Occupation did not vary as much with age in the case of daughters as in the case of sons. A larger proportion of the unmarried daughters 19-23 years of age than of sons of that age were in non-farm pursuits, but about the same proportion of sons and daughters 29-33 years of age were in non-farm pursuits. Farming daughters fall, for the most part, into two groups: (1) daughters married to farmers, a group who have chosen a man, not an occupation; and (2) daughters living at home supported by the parental farm, a group who may, at least in part, be at home because they can find nothing else to do.

Not only was there a larger proportion of non-farming sons in the older group, but there was also a larger proportion of a part-time farming sons. The older sons doubtless had more responsibilities and, therefore, undoubtedly made a greater effort to secure a secondary occupation to supplement their farming activities. In speaking of her son-in-law, one woman said, "He used to farm only, but when he married he began driving the school truck. Said he couldn't support a family on a tenant's meager earnings." About the same proportion of daughters in each of the three age groups were part-time farming.

It is important to know not only chronological ages, but also "occupational ages."³ How many years had the sons and daughters been out of school? Data obtained on occupational ages were not as accurate as data obtained on chronological ages.⁴ However, data obtained on occupational ages show the same general tendency as data on chronological ages; namely, for sons and daughters in non-farming occupations and part-time farming occupations to be the occupationally older group (Table 20).

¹As will be recalled, there was a disagreement in the replies of parents and children as to the age group in which the child belonged in only 7 per cent of the cases.

²Sixty per cent of the sons and daughters in the town or city at the time of the study spent some time on the parental farm after leaving school.

³By "occupational age" is meant the number of years since leaving school.

⁴Year of leaving school was obtained from school records for about one-third of the group. Sixty-three per cent of these records agreed with information furnished by the family.

Table 20. Number of Years Sons and Daughters Studied Have Been Out of School
Classified by Occupation

Number of years out of school	Number of sons				Number of daughters			
	Farming	Non- farming	Part-time farming	Total	Farming	Non- farming	Part-time farming	Total
Less than 5 years	109	27	7	143	123	33	12	168
5-9 years	208	68	24	300	171	81	17	269
10-14 years	110	61	28	199	119	62	9	190
15 years and over	40	17	6	63	38	17	6	61
Total ^a	467	173	65	705	451	193	44	688
Percentage distribution								
Less than 5 years	76.2	18.9	4.9	100.0	73.2	19.6	7.2	100.0
5-9 years	69.3	22.6	8.1	100.0	63.6	30.1	6.3	100.0
10-14 years	55.3	30.7	14.0	100.0	62.6	32.6	4.8	100.0
15 years and over	63.5	27.0	9.5	100.0	62.3	27.9	9.8	100.0
Total ¹	66.2	24.5	9.3	100.0	65.6	28.1	6.3	100.0

^aOne farming son, two farming daughters had no schooling.

Formal Education

As may be noted (Table 21), daughters had, on the whole, more education than sons. More sons had been to college, but more daughters were college graduates.⁵ This is probably due to the fact that a number of daughters were teachers, a profession which requires, in the majority of instances, a college degree. About 19 per cent of the sons and 28 per cent of the daughters were high-school graduates. Daughters more often took vocational courses than sons.

There was quite a difference in the formal educations of sons and daughters in the three occupational groups; those with college degrees being more likely to have non-farm work, those with eighth grade schooling and under farm work.⁶ The majority of high school graduates as well as the sons and daughters who had had some high school training were farming. It is interesting to note that the majority of sons who attended but did not complete college were farming. A great many daughters in this group were likewise farming. This, it would seem, could be used as an argument for the introduction of courses in the first year or two of the curriculum of the Agricultural College which would make for more effective farming and farm home-making. Sons and daughters who had taken vocational courses were, as would be expected, more often in non-farm occupations. Indeed, many took these courses for the special purpose of making their livelihood in non-farm work.

What kind of schools did these sons and daughters attend and what was their scholarship while in school? Were these factors, too, related to types of occupations followed; and if so, to what extent? As might be expected, county agricultural and Smith Hughes high schools contributed relatively more farmers, fewer non-farmers. It is good that this is true, for Mississippi has too few trained farmers. Undoubtedly if boys and girls from Smith-Hughes and county agricultural high schools continue to enter farming, the level of the whole occupation will be raised.

Preparatory schools contributed more non-farming daughters. In "other" high schools the proportion of sons and daughters who were farming and non-farming was about the same. The proportion of non-farmers was greater for

⁵Those who attended high-school departments of college were classified as school students. College refers to training beyond the twelfth grade.

⁶Nine per cent of the children would have been placed in another education category had the information they furnished been used rather than that of their parents. See Appendix, p. 110 for discussion.

Table 21. Formal Educations of Sons and Daughters Studied Classified by Occupation

Formal education ^a	Number of sons				Number of daughters			
	Farming	Non- Part-time		Total	Farming	Non- Part-time		Total
		farming	farming			farming	farming	
No schooling	1	—	—	1	2	—	—	2
Eighth grade and under	277	48	30	355	187	35	16	238
Elementary school training and vocational course	2	3	—	5	—	2	—	2
High-school training	126	55	21	202	166	65	11	242
High-school training and vocational course	1	9	1	11	2	12	1	15
High-school graduate	39	31	6	76	70	23	10	103
High school graduate and vocational course	2	3	—	5	13	26	—	39
College training	20	17	4	41	11	17	6	34
College graduate or more	—	7	3	10	2	13	—	15
Total	468	173	65	706	453	193	44	690

Percentage distribution

No schooling	—	—	—	—	—	—	—	—
Eighth grade and under	78.0	13.5	8.5	100.0	78.6	14.7	6.7	100.0
Elementary school training and vocational course	40.0	60.0	—	100.0	—	100.0	—	100.0
High-school training	62.4	27.2	10.4	100.0	68.6	26.9	4.5	100.0
High-school training and vocational course	9.1	81.8	9.1	100.0	13.3	80.0	6.7	100.0
High-school graduate	51.3	40.8	7.9	100.0	68.0	22.3	9.7	100.0
High school graduate and vocational course	40.0	60.0	—	100.0	33.3	66.7	—	100.0
College training	48.8	41.4	9.8	100.0	32.4	50.0	17.6	100.0
College graduate or more	—	70.0	30.0	100.0	13.3	86.7	—	100.0
Total	66.3	24.5	9.2	100.0	65.7	27.9	6.4	100.0

^aGrade when child left school. Preliminary testing showed that this could be remembered more easily than last grade finished.

Table 22. Kind of High School Attended by Sons and Daughters Studied Classified by Occupation

Kind of high school attended ^a	Number of sons				Number of daughters			
	Farming	Non- Part-time		Total	Farming	Non- Part-time		Total
		farming	farming			farming	farming	
Other	91	60	21	172	142	82	8	232
Smith-Hughes	72	28	6	106	87	37	15	139
County Agricultural and Smith-Hughes	11	24	5	40	21	21	2	44
Preparatory	9	7	1	17	6	13	1	20
County Agricultural	6	3	1	10	8	3	2	13
Total	189	122	34	345	264	156	28	448

Percentage distribution

Other	52.9	34.9	12.2	100.0	61.2	35.3	3.5	100.0
Smith-Hughes	67.9	26.4	5.7	100.0	62.6	26.6	10.8	100.0
County Agricultural and Smith-Hughes	27.5	60.0	12.5	100.0	47.7	47.7	4.6	100.0
Preparatory	52.9	41.2	5.9	100.0	30.0	65.0	5.8	100.0
County Agricultural	60.0	30.0	10.0	100.0	61.5	23.1	15.4	100.0
Total	54.8	35.3	9.9	100.0	58.9	34.8	6.3	100.0

^aAt time son or daughter left school.

sons and daughters who attended schools having both a county agricultural and Smith-Hughes department. This was due to the fact that the majority of the sons and daughters who had attended high schools with both county agricultural and Smith-Hughes departments attended Sunflower and Tate County Agricultural High Schools, schools with a junior college department.

One explanation of the large proportion of sons and daughters found in non-farming occupations who had attended county agricultural and Smith-Hughes, and preparatory schools is the fact that the majority of these children lived in school dormitories and were thus brought in closer contact with their teachers (Table 23). More of this group went to college, and college-trained individuals were more likely to be in non-farm occupations. The personalities of the superintendents and teachers in these schools undoubtedly had something to do with the formal education obtained by their students. A number of parents especially mentioned the influence on their boys and girls of Mr. Gainey, a former superintendent of Tate County Agricultural High School. One mother remarked, "My son has often said that after every talk Mr. Gainey made, he renewed his efforts to get an education."

Table 23. Relation of Place of Residence of Sons and Daughters During High School to Occupation

Place of residence during high school	Number of sons				Number of daughters			
	Farming	Non-farming	Part-time farming	Total	Farming	Non-farming	Part-time farming	Total
Dormitory	19	21	5	45	21	31	3	55
Home	448	152	60	660	430	162	41	633
Total	467	173	65	705	451	193	44	688
Percentage distribution								
Dormitory	42.2	46.7	11.1	100.0	38.2	56.4	5.4	100.0
Home	67.9	23.0	9.1	100.0	67.9	25.6	6.5	100.0
Total	66.2	24.5	9.3	100.0	65.6	28.1	6.3	100.0

Table 24 shows the relation of the scholarship record to type of occupation. As may be noted, the scholarship of sons and daughters in non-farm occupations was higher. A poor school record is not necessarily due to difficulty in learning. It may be due in the case of this group to irregular attendance, lack of interest, and lack of facilities at home for study. One occasionally found such notes as these inserted in the scholarship record: "Did fine while in school. Present 44 days first term, 43 days next." "Capable of doing good work but failed because of irregular attendance."

Since education seemed to be a factor in the type of occupation followed, and since a college degree seemed to be an especially important factor, it was decided to include questions about methods of financing college education, the colleges attended, and the major subject in college in the schedule; that is, to get detailed information about the college-trained boys and girls.

Table 24. Scholarship Record During the Last Year in School of Sons and Daughters Classified by Occupation

Scholarship record ^a	Number of sons				Number of daughters			
	Farming	Non-farming	Part-time farming	Total	Farming	Non-farming	Part-time farming	Total
Good	6	12	3	21	24	23	5	52
Fair	44	32	3	79	63	48	6	117
Poor	86	25	5	116	54	18	3	75
Total	136	69	11	216	141	89	14	244
Percentage distribution								
Good	28.6	57.1	14.3	100.0	46.2	44.2	9.6	100.0
Fair	55.7	40.5	3.8	100.0	53.8	41.1	5.1	100.0
Poor	74.2	21.5	4.3	100.0	72.0	24.0	4.0	100.0
Total	63.0	31.0	6.0	100.0	57.8	36.5	5.7	100.0

^aGood meant grades of A and B; fair, grades of B and C; poor, grades of D and failure; those making good grades in some subjects and poor grades in other subjects classified as fair.

As has been shown, there was a 6 per cent disagreement in the data obtained from the parental family and the data obtained from the young people as to whether or not they attended college; there was a 24 per cent disagreement as to who financed the college education.⁷ Disagreements as to the methods of earning their way in college and the major subject were less, being 4 per cent and 13 per cent, respectively.

Table 25. Method of Financing College Education Used by Sons and Daughters Attending College

Method of financing college education	Sons	Daughters	Total
	Number	Number	Number
Parents financed	20	34	54
Earned part, parents paid part	15	12	27
Earned all	4	6	10
Others financed	1	3	4
Earned part, borrowed part	4	—	4
Earned part, parents paid part, borrowed part	1	—	1
Total ¹	45	55	100

In only a little over 50 per cent of the cases did the parents finance their children's entire way through college (Table 25). Eighteen per cent received no help from their parents, and 28 per cent had some help. Had the methods of financing obtained from the child been listed instead of those obtained from the parents, the part played by the parents would have been considerably less.⁸ Parents more often financed their daughter's education than their son's education. Information was not obtained on the methods used by the parents in financing the college education of their children, but a number of parents spoke of borrowing, of selling timber, or of cashing in on insurance policies.

As may be noted, "Parents financed" was the most usual method of meeting college expenses. The next was for the son or daughter to earn part of his or her way and parents to pay part. More daughters than sons earned all their way. This was generally done by teaching.

Table 26. Method of Earning of Sons and Daughters Who Earned All or Part of Their Way Through College

Method of earning way through college	Sons	Daughters	Total
	Number	Number	Number
Farming	8	—	8
Waiting on tables	1	7	8
Teaching	—	7	7
Cleaning	4	2	6
Driving truck	3	—	3
Tutoring	2	—	2
Playing football	2	—	2
Delivery boy	2	—	2
Firing furnace	1	—	1
Doing housework	—	1	1
Clerking	—	1	1
Preaching	1	—	1
Total	24	18	42

As may be observed the sons more frequently made their way or part of their way through college by farming than by any other method (Table 26). When the price of cotton was high, it was possible for a farm boy to make a cotton crop by staying at home the spring semester and attending college the winter semester and during the summer school. The profits from one crop would usually meet college expenses for the year. This was not true, however, after the price of cotton began to fall. A relatively large number of

⁷Appendix A, p. 110.

⁸Appendix A, p. 110.

girls made their way through college by teaching a year or two after they graduated from high school. Working as a waitress in college was also an equally important method used by rural girls to earn at least part of their way through college. Other methods mentioned were cleaning, housework and clerking. More boys earned part of their way through college than girls. This was undoubtedly due in part to the fact that more opportunities were provided boys. Then, too, the attitude of parents may be somewhat responsible. "Oh, it's easier for a boy to work his way than a girl", was a comment which was frequently heard.

The hundred sons and daughters who had college training attended 24 colleges in the State (Table 27). A few attended more than one college. Only six attended colleges outside the State. State-supported colleges were more frequently attended than colleges privately supported or supported by churches. All "other colleges" attended in the State except Gulf Park were church-supported. Expenses are, of course, less in State-supported colleges. Junior colleges were attended more often than senior colleges. The State-supported junior college makes college training possible for many rural boys and girls. Junior colleges are usually nearer home and expenses are less than in the senior colleges. Board generally ranges around \$12 or \$13 a month. Total expenses for the year are rarely over \$200. Many earn part of their expenses. These State-supported junior colleges have been in operation for only a few years, but are gaining rapidly in popularity.

It is interesting to note that of the colleges attended by boys, Mississippi State College, the agricultural college of the State, attracted most of the sons. State Teachers College was the most popular college for the daughters. One is, therefore, not surprised to find education and agriculture among the sub-

Table 27. Colleges Attended by the Sons and Daughters Studied

Colleges attended	Sons Number	Daughters Number	Total Number
Mississippi colleges	46	63	109
State supported	36	40	76
Senior colleges	19	22	41
Mississippi State College	13	—	13
State Teachers College	1	11	12
Delta State Teachers College	3	5	8
University of Mississippi	2	2	4
Mississippi State College for Women	—	4	4
Junior colleges	17	18	35
East Mississippi Junior College	4	5	9
Northwest Mississippi Junior College	4	5	9
Sunflower County Junior College	3	6	9
Copiah-Lincoln Junior College	3	2	5
Hinds Junior College	2	—	2
East Central Junior College	1	—	1
Other Colleges	10	23	33
Senior colleges	4	6	10
Mississippi College	3	—	3
Blue Mountain College	—	3	3
Mississippi Woman's College	—	3	3
Millsaps College	1	—	1
Junior colleges	6	17	23
Bennett Academy	4	5	9
Grenada College ^a	—	4	4
Hillman College	—	3	3
Gulf Park College	—	3	3
Clarke Memorial College	2	—	2
Whitworth College	—	2	2
Colleges outside the State	3	3	6
Total	49	66	115

^aFormerly a senior college.

jects most frequently majored in by the group. Boys specializing in agriculture, however, do not necessarily return to the farm. They often secure non-farm positions in which technical training in agriculture is essential.

Lack of an education and lack of an opportunity for an education are two of the factors that produced the occupational distribution found in the group studied. Large numbers of sons and daughters are forced to enter farming. Some are pushed into this occupation who are not suited to it. Some do not have the physical strength to farm. Others dislike the occupation and follow it only because other occupations are almost closed to them. These groups spoil the market for the group who are physically adapted for and like farm life. Each farm child should be helped into the occupation where he can do the best for himself and his state. This means provision for such a range of vocational training that every child can be prepared to compete for a livelihood in the occupation best suited to his talents.

Table 28. Major Subject of the 41 Sons and Daughters Having Had More Than Two Years of College Training

Major subject	Number
Agriculture	8
Business	3
Education	11
Engineering	1
English	9
History	1
Home Economics	3
Medicine	1
Music	3
Science	1
Total	41

Marital Status

The relation of marital status, the third factor to be considered in this chapter, to type of occupation is shown in Table 29. About 53 per cent of the sons were married; 75 per cent of the daughters. Daughters married earlier than did sons. Most of the group who were married had been married but once. Five sons and nine daughters had been married more than once. Nine of the fourteen married more than once had been divorced from their first spouse. Of the group married more than once there was one living with a third husband.

There was little difference in the proportion of sons and daughters who were married in the three occupational groups. That this is so is due, of course, to the fact that non-cash assistants and farm-home assistants were included in the farming group. If these two groups had been excluded, the

Table 29. Marital Status of Sons and Daughters Studied Classified by Occupation

Marital status	Number of sons				Number of daughters			
	Farming	Non-farming	Part-time farming	Total	Farming	Non-farming	Part-time farming	Total
Single	222	91	17	330	117	43	10	170
Married once	243	81	47	371	331	147	33	511
Married more than once	3	1	1	5	5	3	1	9
Total ¹	468	173	65	706	453	193	44	690
Percentage distribution								
Single	67.3	27.6	5.1	100.0	68.8	25.3	5.9	100.0
Married once	65.5	21.8	12.7	100.0	64.7	28.8	6.5	100.0
Married more than once	60.0	20.0	20.0	100.0	55.6	33.3	11.1	100.0
Total	66.3	24.5	9.2	100.0	65.7	27.9	6.4	100.0

proportion married in the farming group would have been much higher; this naturally follows, for most of the farming daughters derived their classification from being married to farmers. A farm operator can scarcely get along without a wife, so close is the relation of the farm business to that of the farm home.

Farming children marry earlier than those in non-farm occupations (Table 30). Quite a number of farming boys and girls who married at a very early age were encountered. W, a 23-year-old son of one of the families, had recently married a 13-year-old girl. Mrs. X's 17-year-old daughter had been married for some time. Mrs. Y's oldest son married, at the age of 18 years, a 15-year-old girl. The parents made the best of it. They gave him a mule and two dairy cows to start out for himself. The son is now 21 years of age and has a wife and three children to support. Some leave school to marry. A great number marry before they are established in an occupation. Necessity then demands that they take the work most easily and speedily secured. Farming is the work they know best and the work which, under the circumstances, they are more likely to take up. Indeed, they have little choice.

Table 30. Ages of Married Sons and Daughters Classified by Occupation

Age groups	Number of sons				Number of daughters			
	Farming	Non- Part-time		Total	Farming	Non- Part-time		Total
		farming	farming			farming	farming	
19-23 years	72	7	8	87	129	37	9	175
24-28 years	111	33	14	158	128	58	14	200
29-33 years	63	42	26	131	79	55	11	145
Total	246	82	48	376	336	150	34	520
Percentage distribution								
19-23 years	76.2	18.9	4.9	100.0	73.2	19.6	7.2	100.0
24-28 years	69.3	22.7	8.0	100.0	63.5	30.2	6.3	100.0
29-33 years	55.3	30.7	14.0	100.0	62.6	32.6	4.8	100.0
Total	63.6	26.9	9.5	100.0	64.6	28.9	6.5	100.0

Another important factor to be considered in marital status is whether or not the son or daughter is married to the daughter or son of a farmer. It is a well established fact that farmers of one generation provide the farmers of the next. One rarely hears of a city-reared boy becoming a farmer. It will, therefore, be of interest to know what happened when the farm-reared youth of this study married a non-farmer's child. Was he or she more or less likely to follow the occupation of farming? As may be noted (Table 31), they were more likely to be engaged in non-agricultural work.

Table 31. Occupations of Parental Families of Wives and Husbands of Sons and Daughters Classified by Occupation of Sons and Daughters

Occupations of parental families of wives and husbands of sons and daughters	Number of sons				Number of daughters			
	Farming	Non- Part-time		Total	Farming	Non- Part-time		Total
		farming	farming			farming	farming	
Farming	228	47	46	321	332	76	30	438
Non-farming	18	35	2	55	4	72	4	80
Unknown	—	—	—	—	—	2	—	2
Total	246	82	48	376	336	150	34	520
Percentage distribution								
Farming	71.0	14.7	14.3	100.0	75.8	17.4	6.8	100.0
Non-farming	32.7	63.7	3.6	100.0	5.0	90.0	5.0	100.0
Unknown	—	—	—	—	—	—	—	100.0
Total	65.4	21.8	12.8	100.0	64.6	28.8	6.6	100.0

Farming daughters were usually married to sons of farmers, for married farming daughters (by definition) were those married to farmers; farmers were usually farmers' sons; therefore, farming daughters were usually married to sons of farmers. Farming sons were six times more likely to marry daughters of non-farmers than farming daughters were to marry sons of non-farmers.

Marriage of farming sons with non-farmers' daughters or non-farming sons with farmers' daughters suggests an intermixture of rural and urban culture. However, it has been shown that the farm gets little benefit from such an intermixture, for farmers and their wives were usually both farm-reared.

Place of Residence

Table 32. Place of Residence of Sons and Daughters Classified by Occupation

Place of residence	Number of sons				Number of daughters			
	Farming	Non-farming	Part-time farming	Total	Farming	Non-farming	Part-time farming	Total
Open country	458	40	58	556	452	44	43	539
Town of less than 10,000 inhabitants.....	2	61	4	67	1	53	1	55
City of 10,000 inhabi- tants and over.....	2	72	3	77	—	96	—	96
Unknown	6	—	—	6	—	—	—	—
Total	468	173	65	706	453	193	44	690

Percentage distribution								
Open country	82.4	7.2	10.4	100.0	83.9	8.2	7.9	100.0
Town of less than 10,000 inhabitants.....	3.0	91.0	6.0	100.0	1.8	96.4	1.8	100.0
City of 10,000 inhabi- tants and over.....	2.6	93.5	3.9	100.0	—	100.0	—	100.0
Unknown	—	—	—	100.0	—	—	—	—
Total	66.3	24.5	9.2	100.0	65.7	27.9	6.4	100.0

Ninety-one per cent of the sons living in the open country were farmers. Ninety-nine per cent of the farming sons lived in the open country. One may thus say of this group "Tell me what he does and I will tell you where he lives" or "Tell me where he lives and I will tell you what he does."

Undoubtedly the principal factor in the large proportion of sons and daughters engaged in farming in this study was the fact that the majority lived in the open country where opportunities for engaging in non-farm work were limited. Indeed farming was about the only occupation there was to follow. Rural industries were practically non-existent. Of those sons who lived in the open country and had non-farm occupations the majority were unskilled and semi-skilled laborers as truck drivers, road workers and the like. Daughters in non-agricultural occupations in the open country were generally teachers.

CHAPTER V.

THE RELATION OF THE CHARACTERISTICS AND COMPOSITION OF THE PARENTAL FAMILY TO TYPE OF OCCUPATION

There are situations in the parental family which also affect the occupations entered by the children. Some of these situations are rather intangible and often cannot be obtained by direct questions. However, the questions asked often led the parents or the children to reveal some of these situations. Parents often told of their ambitions and struggles for their children. Such information was added to the schedule when it was checked at the end of the

day. The following extracts (two from families whose children were occupationally successful; two, occupationally unsuccessful), it is believed, may throw some light on some of the intangible factors in the occupational careers of these children.

Mrs. B has four children ranging from 17 to 32 years of age. Her three oldest children have college training; her youngest is still in high school. The oldest daughter taught school before she married a successful insurance agent in a nearby city. Her second child is now teaching in a college. Her third, a boy, is at home farming. Mrs. B said, "We made the sacrifice to give our children a good education. We did without a car, trips and many other things our neighbors had."

Mrs. C. owned a small farm of 55 acres, quite inadequate for supporting a family of thirteen. Yet in spite of this, the C children are occupationally successful. Mrs. C attributes this to two facts: (1) that she never let her children miss school for anything except sickness; (2) that she assisted them with their lessons at night. The C's have not helped any of their children in a financial way in college; they have not been able to do so. However, three of their children have had college training. The oldest taught after she graduated from high school and sent herself to college from her savings. The second daughter did likewise. Both borrowed some money from the Feild Cooperative Association. The oldest helped her third sister through college. In this family composed largely of girls there are two teachers, a trained nurse, and a farm owner's wife. The family at the time of the visit had lost their farm and were renters. However, they were getting along well with the help of their older children.

Mr. D has always share-cropped.¹ His oldest son reached the second grade in school and is a wage hand in Arkansas. His oldest daughter reached the sixth grade. The mother spoke of her as "highly educated." "Just when she could have helped us she up and married a no-count man who couldn't support her." Mr. D's other children are all at home. None of his other children have been to school except the 17-year-old boy. "They didn't have enough clothes to go to school", he said.

Mr. E never went to school, but Mrs. E had a common school education. She can read as well as write. They have eleven children none of whom ever attended school. Mr. E would not let his children go to school, for he said they were needed in the crops. The E family never had a car; never had anything to do with their neighbors; never went to church or to any social function. They have rented the same place for 32 years. They saved enough to buy land had they wanted to become owners, but Mr. E was satisfied with arrangements. The children in this family range from 29 to 54 years of age. Three of the daughters and one of the sons are single. These four children are living at home. The women work as wage hands on the farm. One of the older girls married a laborer who worked in a large town. She has tried to get her sisters away from home, but they feel timid about meeting strangers and refuse her invitations.

The attitude of the parents toward farming was often quite evident and undoubtedly had some influence upon the type of occupation followed by the son or daughter. Mothers frequently gave the occupation of their sons as "just a farmer." Several said quite frankly, "No, my son is no farmer. He had enough of that in his school days." On the other hand, a number pointed with pride to their farming children. One father, all of whose sons were

¹This family was in the preliminary study.

farmers said, "Farming is the occupation I want my sons to follow. There's a good living in it if one works hard."

Occupations of Parents and of Brothers and Sisters

In this study, unlike other studies of farm youth, the occupational history of the father does not vary. Farming was the father's main occupation when the individual concerned was in school. It has been shown that the greatest proportion of farmers come from homes in which the father has always been a full-time farmer.² Herein lies one factor in the high percentage of sons and daughters in this study found in farm occupations. However, that this is not the main factor is shown by a comparison of the proportion of sons entering non-farming pursuits from Ohio and Mississippi farm families. In Beck's and Lively's study of Ohio farm children, 64 per cent of the "male migrants" were non-farmers, but only 54 per cent of the migrants from families who always farmed were non-farmers.³ In this study only 34 per cent of the sons not living on the home farm were engaged in non-agricultural work.

Not only the occupation of the parents but also that of the older brothers and sisters influenced the type of occupation followed by the children concerned. Twenty-one per cent of the sons with one or more older brothers who farmed were engaged in non-farm work, while 36 per cent with older brothers none of whom farmed were engaged in non-farm work (Table 33). The difference was even greater in case of daughters. Older brothers and sisters in non-agricultural occupations serve as one of the main channels used in securing work off the farm. Indeed, country children without relatives in the town or the city have little opportunity for making non-agricultural contacts. This is especially true in the case of daughters, as parents are less willing to have

Table 33. Relation of Occupations of Sons Studied to Occupations of Older Brothers

Occupations of older brothers	Number of sons			
	Farming	Non-farming	Part-time farming	Total
With older brothers one or more of whom farm ...	289	71	26	336
With older brothers none of whom farm	50	32	7	89
No older brothers	179	70	32	281
Total	468	173	65	706
Percentage distribution				
With older brothers one or more of whom farm ...	71.1	21.1	7.8	100.0
With older brothers none of whom farm	56.1	36.0	7.9	100.0
No older brothers	63.7	24.9	11.4	100.0
Total	66.3	24.5	9.2	100.0

Table 34. Relation of Occupations of Daughters Studied to Occupations of Older Sisters

Occupations of older sisters	Number of daughters			
	Farming	Non-farming	Part-time farming	Total
With older sisters one or more of whom farm	236	94	22	352
With older sisters none of whom farm	30	31	4	65
No older sisters	187	68	18	273
Total	453	193	44	690
Percentage distribution				
With older sisters one or more of whom farm	67.0	26.7	6.3	100.0
With older sisters none of whom farm	46.2	47.6	6.2	100.0
No older sisters	68.5	24.9	6.6	100.0
Total	65.6	28.1	6.3	100.0

²Hypes, Rapport and Kennedy, *Op. Cit.* p. 20.

Beck and Lively, *Op. Cit.* p. 18.

³Ibid, pp. 8, 18.

their daughters strike out for the city without some relative with whom to stay. One of the greatest vocational needs of farm children of this state is an adequate system of employment bureaus which would assist those desiring work away from the farm to secure it.

The case of F was typical of several encountered in the study who had older brothers or sisters in the city. F's brother came home to see the family and insisted that F return with him to the city where she could secure employment. She has been in the same job now for several years and has been able to aid the family financially during the depression.

Schooling of the Parents and of the Older Brothers and Sisters

Sons and daughters in families where the father and mother had received a good education⁴ or where the older brothers and sisters had had a good edu-

Table 35. Schooling of the Parents of the Sons and Daughters Studied Classified by Occupations of Sons and Daughters

Schooling of parents	Number of sons				Number of daughters			
	Farming	Non- farming	Part-time farming	Total	Farming	Non- farming	Part-time farming	Total
Both parents under 4th grade	74	11	7	92	49	11	2	62
Father under 4th grade; mother 4-9 grade.....	78	19	13	110	57	29	6	92
Mother under 4th grade; father 4-9 grade.....	28	7	4	39	21	5	1	27
Both parents 4-9 grade.....	212	87	25	324	258	100	29	387
Mother high school; father less	11	24	2	37	18	15	2	35
Father high school; mother less	22	6	3	31	11	4	2	17
Both parents high school.....	4	1	3	8	6	9	1	16
Mother college; father less	8	8	2	18	4	4	1	9
Father college; mother less	8	1	1	10	5	4	—	9
Both college	2	5	—	7	1	2	—	3
Unknown ^a	21	4	5	30	23	10	—	33
Total	468	173	65	706	453	193	44	690
Percentage distribution								
Both parents under 4th grade	80.3	12.0	7.6	100.0	79.0	17.8	3.2	100.0
Father under 4th grade; mother 4-9 grade.....	70.9	17.3	11.8	100.0	62.0	31.5	6.5	100.0
Mother under 4th grade; father 4-9 grade.....	71.8	17.9	10.3	100.0	77.8	18.5	3.7	100.0
Both parents 4-9 grade.....	65.4	26.9	7.7	100.0	66.7	25.8	7.5	100.0
Mother high school; father less	29.7	64.9	5.4	100.0	51.4	42.9	5.7	100.0
Father high school; mother less	71.0	19.3	9.7	100.0	64.7	23.5	11.8	100.0
Both parents high school.....	50.0	12.5	37.5	100.0	37.5	56.3	6.2	100.0
Mother college; father less	44.5	44.5	11.0	100.0	44.5	44.5	11.0	100.0
Father college; mother less	80.0	10.0	10.0	100.0	55.5	44.5	—	100.0
Both college	28.6	71.4	—	100.0	33.3	66.7	—	100.0
Unknown	70.0	13.3	16.7	100.0	69.7	30.3	—	100.0
Total	66.3	24.5	9.2	100.0	65.6	28.0	6.4	100.0

^aThis group includes a few sons and daughters who did not have a father or mother when they were in school. Step-parents were counted as parents if they were in the family when the child was attending school.

⁴To get the schooling of the parents they were asked about subjects they had studied in school. History and geography indicated fourth grade or above, Algebra and Latin that they had reached high school.

Table 36. Relation of Education of Sons and Daughters Studied to Education of Their Older Brothers and Sisters^a

Education of sons and daughters	Number of sons				Number of daughters			
	With older brother or sister having been to college	With older brother or sister having finished high school	No older brother or sister having finished high school	Total	With older brother or sister having been to college	With older brother or sister having finished high school	No older brother or sister having finished high school	Total
No schooling	—	—	1	1	—	—	2	2
Eighth grade and under	7	16	246	269	2	5	173	180
High-school training	15	29	113	157	17	27	158	202
High-school graduate	13	23	29	65	29	40	52	121
College training	17	10	10	37	21	5	8	34
Total	52	78	399	529	69	77	393	539
Percentage distribution								
No schooling	—	—	.2	.2	—	—	.6	.4
Eighth grade and under	13.5	20.5	61.7	50.8	3.0	6.5	44.0	33.4
High-school training	28.8	37.2	28.3	29.7	24.6	35.1	40.2	37.5
High-school graduate	25.0	29.5	7.3	12.3	42.0	51.9	13.2	22.4
College training	32.7	12.8	2.5	7.0	30.4	6.5	2.0	6.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

^aOnly children with one or more older brothers or sisters are included in this tabulation.

cation had in turn more education and were, therefore, less likely to be found in farm occupations. Although the percentage of children who came from families in which either the mother or father had high school training or more was small, the decidedly lower percentage of their children entering farming is significant. If the schooling of the mother is taken as the criterion, there is a closer relation between advanced education and non-farming than in the case of the father (Table 35). This was true of both sons and daughters. Mothers had more schooling than fathers. Many of the fathers interviewed spoke of having to "quit school to work in the field."

Since the schooling of the parents, especially that of the mother, is closely related to the schooling of the children it would seem that for the best interest of the state, as well as the individual, it is especially desirable that rural girls, the future farm mothers, be well educated. With well-educated mothers, the farm children of the future will be inspired to seek more training. Many more will then enter the higher-paid fields. This will release some from farming which will send up the incomes of those who remain in this occupation.

The education of the older brothers and sisters was another factor which was somewhat related to the schooling and in turn the occupations of the sons and daughters. As may be observed (Table 36) sons and daughters with older brothers and sisters who had received college training were more likely to have had college training than were those whose older brothers and sisters had not graduated from high school. In a number of families visited the older children had assisted their younger brothers and sisters in getting an education. In family T for instance, the oldest daughter was a school teacher and encouraged her younger brothers and sisters to take an education. All of the younger children in this family had worked part of their way through boarding school, for the family lived in a district in which there was no accredited high school.

Health of the Child and of the Parental Family

Some children miss considerable time from school because of illness or an illness in the family and fail to return. A number reported their children having quit school following an operation or an illness of the mother. Especially was this true of the daughters. Many daughters quit school at the death of their mothers; sons at the death of their father. The effect of physical incapacity upon the occupational career of the child will be discussed in Chapter X. The effect of incapacity of the parents upon the child is shown in Table 37.⁵ As may be noted a somewhat larger proportion of sons and daughters from families in which the mother or father was incapacitated was farming. That the proportion was not greater is doubtless due to the fact that when a parent is incapacitated only one or two children remain on the home farm. The facts that these families were large and that there was generally at least one son or daughter who remained on the farm anyway probably account for the relatively small difference shown. Then, too, the number of cases in which the parents were incapacitated was limited.

The case of G illustrates the effect which the incapacity of a parent even when the family income is adequate, often has upon the vocational career of the child. G writes, "Mother was sick the last two years I was in high school. I was the only girl in the family and, therefore, had to miss school lots. I finished high school for I was determined to do it. I wanted to go to college, but was handicapped this way."

The data obtained on the other question asked pertaining to health in the parental family "Whether there had been any illness in the parental family costing \$100.00 or more or resulting in the mortgage during the year before or the year during which the boy or girl left school" did not yield as much differences in the three occupational groups as did the first question. This, it is believed, is due to the fact that for two of the groups it is not a factor at all; the very poor who, if they have expensive medical attention, received it gratis; and the well-to-do, to whom the expenditure of \$100.00 for medical services would not necessarily mean the altering of the vocational plans of their children.

About 70 per cent of the sons and daughters whose families had an illness occurring the year before that in which they left school, and costing \$100.00 or more or resulting in a mortgage were farmers; while 65 per cent of the sons and daughters without this expense in their parental families were farmers (Table 38). Extra expenditure such as this results in some cases in children being withdrawn from school. Early withdrawal from school generally leads to taking the most available work—farming.

The parents quite frequently spoke of serious illnesses in the home and the effect that these illnesses had had on the careers of their children. One mother said, "My boy that died cost us \$1300.00. My illness cost \$600.00. We had to mortgage our farm to pay doctor and hospital bills and had to take our boy out of school. The greatest thing the Government could do for rural people would be to establish free or very cheap hospital and medical service."

H's case was one of the saddest encountered. H's father had had college training. He was very proud of his son and ambitious for him to go to college and study forestry when he grew up. However, this ambition was not realized, for the father died after a long and expensive illness. A portion of the land had to be sold to pay the expenses. Then a younger brother had his

⁵Incapacitated here was defined as not carrying on normal occupational tasks because of lack of health. A number declared they were not physically able to do the work they did. However, if they did it they were not classified as incapacitated.

foot caught in a corn husker. H was not promoted in school after he was fifteen years old, for he could not attend school regularly. H, now 21 years old, is the mainstay of the family. Recently, to his delight, he obtained C. W. A. work as a forest ranger, but he was given only a few hours. Now the work is discontinued.

Table 37. Incapacitation of Parents of Sons and Daughters Studied Classified by Occupation of Sons and Daughters^a

Incapacitation of parents	Number of sons				Number of daughters			
	Farming	Non-farming	Part-time farming	Total	Farming	Non-farming	Part-time farming	Total
Mother incapacitated.....	12	3	1	16	18	4	2	24
Father incapacitated.....	18	5	2	25	11	3	1	15
Neither incapacitated.....	350	149	53	552	346	153	38	531
Both incapacitated.....	—	1	—	1	3	—	—	3
Total	380	158	56	594	378	160	41	579

Percentage distribution

Mother incapacitated.....	75.0	18.8	6.2	100.0	75.0	16.7	8.3	100.0
Father incapacitated.....	72.0	20.0	8.0	100.0	73.3	20.0	6.7	100.0
Neither incapacitated.....	63.4	27.0	9.6	100.0	64.4	28.5	7.1	100.0
Both incapacitated.....	—	*	—	*	—	—	—	*
Total.....	66.3	24.5	9.2	100.0	65.5	28.0	6.4	100.0

^aChildren from "natural" families only are included in this tabulation.

*Numbers negligible.

Table 38. Illness in the Parental Family During the Year Before or the Year the Son or Daughter Left School Classified by Occupation of Son and Daughter

Illness in parental family	Number of sons				Number of daughters			
	Farming	Non-farming	Part-time farming	Total	Farming	Non-farming	Part-time farming	Total
Having illness costing \$100 or more or resulting in a mortgage.....	78	23	9	110	102	35	8	145
Not having illness costing \$100 or more or resulting in a mortgage.....	390	150	56	596	351	158	36	545
Total	468	173	65	706	453	193	44	690

Percentage distribution

Having illness costing \$100 or more or resulting in a mortgage.....	70.9	20.9	8.2	100.0	70.4	24.1	5.5	100.0
Not having illness costing \$100 or more or resulting in a mortgage.....	65.4	25.2	9.4	100.0	64.4	29.0	6.6	100.0
Total	66.3	24.5	9.2	100.0	65.6	28.0	6.4	100.0

Large expenditures for medicine and medical service which lead to improved health, expenditures which encroach on Mary's and John's vocational budget, are bad enough; but large expenditures for medicine and medical services which, if they are not harmful themselves, are harmful in the long run, preventing correct treatment when it can be most effective, are much worse. Some such cases were encountered, cases where the family were sacrificing the occupational careers of their children for medicaments of no value.

Mrs. I has not been able to do much for her children because almost every dollar has had to go for medicine. One son has epilepsy, and she spent a large amount for medicine claimed to cure. She finally had to send him to a

state institution. A daughter has hypo-thyroid trouble, and she buys "salts", (6 ounces for 85 cents) for her. In order to raise this money she does day labor for farmers in the neighborhood. This mother has literally worked her fingers to the bones to provide medicine for her children. One of her thumbs is almost gone, due to constant quilting. The doctors wanted to cut it off, but she said, "I must have my thumb to make my children a living."

Type of Parental Family at Time of Leaving School

Death of one of the parents seemed to have an effect similar to incapacity; that is, to cause the son to leave school earlier than he otherwise would (Table 40). Families in this study include four types—Natural, broken, reconstructed and rebroken.⁶ By a natural family is meant a family with a husband, wife, and children but no step-parents nor step-children. The fathers or mothers of the family may have been married before, but if they had no living children by the first wife or husband, this family was classified as natural. All fathers and mothers in the natural families were living together except in cases of physical or mental disability.⁷

In addition to the natural family which was the typical form in this study there were broken, reconstructed, and re-broken families. A broken family is a family with one of the parents dead, divorced, or separated. A reconstructed family is a family with man, wife and one or more step-children. A reconstructed family which is broken is called a re-broken family.

As may be noted (Table 39), the great majority of the young people included in this study came from natural families. Only 16 per cent of the group had broken, reconstructed, and re-broken parental families. More of the families were reconstructed than broken.⁸ There are relatively fewer widowed females on farms of Mississippi than in villages and towns.

Fewer sons from natural families were farming due to the fact that they

Table 39. Type of Parental Family of Sons and Daughters Studied at Time of Leaving School Classified by Occupation^a

Type of family	Number of sons				Number of daughters			
	Farming	Non- Part-time		Total	Farming	Non- Part-time		Total
		farming	farming			farming	farming	
Natural	380	158	56	594	378	160	41	579
Broken	49	7	6	62	29	14	1	44
Reconstructed	38	8	3	49	45	19	2	66
Re-broken ^b	1	—	—	1	1	—	—	1
Total ^c	468	173	65	706	453	193	44	690
Percentage distribution								
Natural	64.0	26.6	9.4	100.0	65.3	27.6	7.1	100.0
Broken	79.0	11.3	9.7	100.0	65.9	31.8	2.3	100.0
Reconstructed	77.6	16.3	6.1	100.0	68.2	28.8	3.0	100.0
Re-broken	*	—	—	*	*	—	—	*
Total	66.3	24.5	9.2	100.0	65.7	28.0	6.3	100.0

^aIncluding elementary, secondary and preparatory schools.

^bIn this case the child would be an orphan with neither father nor mother living.

^cFor children never having attended school, the situation when they reached 16 years of age is used.

*Numbers negligible.

⁶This classification was suggested from the discussion by Bruce L. Melvin, *The Sociology of a Village and the Surrounding Territory*, Cornell University Agricultural Experiment Station Bulletin 523 (Ithaca 1930), pp. 28-29.

⁷In one case the father spent most of his time away from the family operating another farm.

⁸The information pertaining to the type of the parental family which was obtained from the family and from the child showed a high degree of accuracy, the agreement in the replies of the two groups being 98 per cent. See Appendix, p. 110.

Table 40. Age at Leaving School of Sons and Daughters Studied Classified by Type of Parental Family

Age at leaving school	Number of sons from:			Number of daughters from:		
	Natural families	Other families	Total	Natural families	Other families	Total
Below 16 years.....	157	34	191	103	17	120
16-18 years	262	57	319	330	69	399
19 years and over.....	174	21	195	144	25	169
Total	593	112	705	577	111	688

Percentage distribution

Below 16 years.....	82.2	17.8	100.0	85.8	14.2	100.0
16-18 years	82.1	17.9	100.0	82.7	17.3	100.0
19 years and over.....	89.2	10.8	100.0	85.2	14.8	100.0
Total ^a	84.1	15.9	100.0	85.9	16.1	100.0

^aChildren not attending school omitted.

Table 41. Age at Leaving School of Sons and Daughters Studied Classified by Occupation

Age at leaving school	Number of sons				Number of daughters			
	Non-		Part-time		Non-		Part-time	
	Farming	farming	farming	Total	Farming	farming	farming	Total
Below 16 years.....	158	26	7	191	92	20	5	117
16-18 years	205	75	39	319	252	121	29	402
19 years and over.....	104	72	19	195	107	52	10	169
Total ^a	467	173	65	705	451	193	44	688

Percentage distribution

Below 16 years.....	82.7	13.6	3.7	100.0	78.6	17.1	4.3	100.0
16-18 years	64.3	23.5	12.2	100.0	62.7	30.1	7.2	100.0
19 years and over.....	53.3	36.9	9.8	100.0	63.3	30.8	5.9	100.0
Total	66.2	24.5	9.3	100.0	65.6	28.1	6.3	100.0

^aChildren not attending school omitted.

remained in school longer than boys from broken families. This was not the case with daughters. About the same proportion of daughters in natural families left school when they were younger than 16 years as those who left school at 19 years and over.⁹ There are two possible explanations for this: (1) The main career of the majority of daughters was marriage and its usual concomitant, housekeeping; (2) several daughters who on the death of a mother had left school returned when their father remarried.

Size of Parental Family

The next question which arises is, what effect has the size of the parental family upon the proportion of sons and daughters who enter farming and non-farming occupations? Table 42 indicates that there was a slight tendency for the percentage of farming sons and daughters to increase with increasing size of the family. Children in large families had on an average less education and children of less education were more likely to be in farm occupations.¹⁰

Children from large families are often penalized by not having occupational opportunities equal to those of children from small families. The presence of so many young people able to assist on the farm and at home undoubtedly in-

⁹The replies of the family as to the year their sons and daughters left school and the records of the year of leaving school found in the school showed a rather high disagreement (about one-third disagreed). However, as in other cases accuracy of age group—not of age—was all that was desired. Yet inaccuracy in age groups in this case may be great enough to partly obscure the actual relationship of age at leaving school to the type of the parental family.

¹⁰Table 21, p. 28.

creases economic productivity of each farming unit, although not necessarily return per capita. A family who could provide adequate books and clothing for two may not be able to supply them for seven or eight. Cost of rearing children on the farm, though not as great as rearing them in town, is rapidly increasing along with the increased demand for goods and services which can be had only by cash expenditures. Several families in Mr. Z's predicament were encountered in this study. Mr. Z was a renter. He had 12 living children ranging in age from 2 to 22 years. His five oldest children were girls. They, with the exception of the oldest, quit school in the eighth and ninth grades, for Mr. Z was not able to buy the books and clothes which were necessary.

Table 42. Number of Living Children in the Parental Family at the Time Sons and Daughters Studied Left School Classified by Occupations of Sons and Daughters

Number of children in parental family	Number of sons				Number of daughters			
	Farming	Non-farming	Part-time farming	Total	Farming	Non-farming	Part-time farming	Total
One child	2	1	2	5	3	—	2	5
Two children	25	9	3	37	6	3	2	11
Three children	39	22	4	65	28	14	6	48
Four children	32	13	7	52	49	16	5	70
Five children	51	20	5	76	55	30	5	90
Six children	64	17	12	93	49	20	6	75
Seven children	84	25	9	118	71	32	4	107
Eight children	61	22	3	86	61	35	7	103
Nine children	43	20	9	72	40	16	2	58
Ten children	22	11	8	41	38	16	2	56
Eleven children	27	7	3	37	32	7	1	40
Twelve children	10	3	—	13	10	3	—	13
Thirteen or more children	8	3	—	11	11	1	2	14
Total ¹	468	173	65	706	453	193	44	690

Percentage distribution

One child	40.0	20.0	40.0	100.0	60.0	—	40.0	100.0
Two children	67.6	24.3	8.1	100.0	54.5	27.3	18.2	100.0
Three children	60.0	33.8	6.2	100.0	58.3	29.2	12.5	100.0
Four children	61.5	25.0	13.5	100.0	70.0	22.9	7.1	100.0
Five children	67.1	26.3	6.6	100.0	61.1	33.3	5.6	100.0
Six children	68.8	18.3	12.9	100.0	65.3	26.7	8.0	100.0
Seven children	71.2	21.2	7.6	100.0	66.4	29.9	3.7	100.0
Eight children	70.9	25.6	3.5	100.0	59.2	34.0	6.8	100.0
Nine children	59.7	27.8	12.5	100.0	69.0	27.6	3.4	100.0
Ten children	53.7	26.8	19.5	100.0	67.8	28.6	3.6	100.0
Eleven children	73.0	18.9	8.1	100.0	80.0	17.5	2.5	100.0
Twelve children	76.9	23.1	—	100.0	76.9	23.1	—	100.0
Thirteen or more children	72.7	27.3	—	100.0	78.6	7.1	14.3	100.0
Total	66.3	24.5	9.2	100.0	65.7	28.0	6.3	100.0

The average size of the 500 families studied was 7.92 members (2.98 members, however, were not at home). Tenant families as a group averaged .6 more per family than did owner families. There was a greater difference in the size of the completed families of the two tenure groups, for more tenant mothers were still in the child-bearing age than were owner mothers. Natural families in which the mother was 45 years of age or over averaged 7.54 living members for owners, 8.46 living members for tenants, or a difference of about .9 members.

Order of Birth

No evidence was found in this study of any tendency for the first-born son in the family to remain in agriculture more often than subsequent sons

(Table 43). The fact that there were younger brothers to assist on the farm made it possible for the eldest to leave home and seek other work. However, this was not true in the case of daughters. The eldest daughter more often assists in household tasks than her younger sister. She is given less education than the youngest daughter, for she is needed at home. Thus she is more likely to marry a farmer or to continue her work as farm-home assistant.

Last-born children more often followed non-farming pursuits. This, it is believed, was due to the fact that the younger children received more schooling. Only 22 percent of the first, second and third or later children had graduated from high-school or attended college, while 31 per cent of the last-born children had done so. Parents have fewer children dependent on them when the youngest child comes along. Then, too, the youngest is often assisted by older brothers and sisters. Several families were visited in which the older brothers and sisters were assisting the youngest in ascending the occupational ladder. A, the youngest boy in one family interviewed, wanted to be a lawyer. None of his brothers and sisters had gone beyond the ninth grade in school but they were all working to keep A in college.

Table 43. Position of Sons and Daughters Studied in Parental Family at the Time of Leaving School Classified by Occupation

Position in parental family ^a	Number of sons				Number of daughters			
	Farming	Non-farming	Part-time farming	Total	Farming	Non-farming	Part-time farming	Total
First child	111	45	22	178	100	39	11	150
Second child	86	29	9	124	86	37	12	135
Third child or later.....	229	82	27	338	230	93	19	342
Last born child.....	42	17	7	66	37	24	2	63
Total	468	173	65	706	453	193	44	690

Percentage distribution								
First child	62.4	25.3	12.4	100.0	66.7	26.0	7.3	100.0
Second child	69.4	23.4	7.3	100.0	63.7	27.4	8.9	100.0
Third child or later.....	67.8	24.3	7.9	100.0	67.3	27.2	5.5	100.0
Last born child.....	63.6	25.8	10.6	100.0	58.7	38.1	3.2	100.0
Total	66.3	24.5	9.2	100.0	65.7	28.0	6.3	100.0

^aTwins were given the same position in the family. If the third birth, for instance, was twins, then each was counted as the third child but the following child as the fifth.

The Distance from the Parental Home

From Table 44 it would seem that a large proportion of these farm children either wanted to be near home or were forced by circumstances to remain at or near home and thus farm since there was little non-farm work available nearby. The majority of the group, of course, were from 19 to 23 years of age. Many of these were at home with the status of children; that is, working without financial agreement. Then, too, the study was conducted during a business depression. Economic pressure had doubtless sent many sons and daughters back to the parental home for care and protection. The farm population estimates for January 1935, showed an upward trend in the number of persons living on farms, the East South Central States, in which Mississippi is located, showing the greatest net gain.¹¹

Sons were more often living at home than daughters. This was largely due to the fact that marriage is the main career of the daughters; farming the main career of the sons. There was a great tendency, therefore, for sons to remain on the "home farm".

¹¹United States Bureau of Agricultural Economics, **Farm Population Estimates**, January 1, 1935, Mimeographed Report, May, 1935.

**Table 44. Distance from the Parental Home of the Sons and Daughters Studied
Classified by Occupation^a**

Distance from parental home	Number of sons				Number of daughters			
	Farming	Non- Part-time		Total	Farming	Non- Part-time		Total
		farming	farming			farming	farming	
Same farm	239	28	13	280	138	21	12	171
Same community	140	6	27	173	111	5	14	130
Same county	45	31	12	88	89	45	8	142
Bordering county	25	10	6	41	75	20	4	99
Other Mississippi								
County	12	32	2	46	24	40	1	65
Other state or nation...	3	66	5	74	16	62	5	83
Total	464	173	65	702	453	193	44	690
Percentage distribution								
Same farm	85.4	10.0	4.6	100.0	80.7	12.3	7.0	100.0
Same community	80.9	3.5	15.6	100.0	85.4	3.8	10.8	100.0
Same county	51.1	35.2	13.7	100.0	62.7	31.7	5.6	100.0
Bordering county	61.0	24.4	14.6	100.0	75.8	20.2	4.0	100.0
Other Mississippi								
county	26.1	69.6	4.3	100.0	36.9	61.5	1.6	100.0
Other state or nation...	4.0	89.2	6.8	100.0	19.3	74.7	6.0	100.0
Total	66.1	24.6	9.3	100.0	65.7	28.0	6.3	100.0

^aThe location of four farming sons was unknown.

Of those sons and daughters away from home, those from Tate County families were more often living outside the State. Webster County had the greatest proportion of their young people on the same farm or in the same community as their parents. Tate County was, of course, within close vicinity of Memphis where non-farm work was available. Thirty-eight per cent of the sons and 22 per cent of the daughters in non-agricultural work had found jobs outside the state. Mississippi, as has been previously stated is a predominantly rural state and without a doubt does not provide sufficient non-farm work to satisfy the desire and needs of its rural youth. Therefore, they must go outside the state to find it.

CHAPTER VI.

THE RELATION OF SOCIO-ECONOMIC INFLUENCES TO TYPE OF OCCUPATION

There is in addition to the two groups of influences just discussed another group of influences which may affect at least in part the occupational situation of these young people concerned. This group of influences we shall call socio-economic. The financial status of the parental family; the recreational facilities provided by the home; facilities provided by the community; and urban experiences of the children at the time they left school will be included under this discussion.

Financial Status of the Parental Family

More than one half of the parents (58 percent) were landowners when their children left school.¹ Children of owners were more frequently engaged in non-farm pursuits than children of non-owners (Table 46). A larger proportion of tenants' sons entered farming because opportunities in non-agricultural occupations were not as available as for owners' sons. The difference between daughters of families in the two tenure groups was even greater than in the case of sons. Since the occupation of a married daughter is determined

¹Since landowners are older men, they had more children 19 to 34 years, or children within the eligibility limits.

Table 45. Counties in Which Parental Families of Sons and Daughters Studied Resided, 1934, Classified by Distance of Sons and Daughters from Parental Homes

Distance from parental home	Number of sons					Number of daughters						
	Jefferson Davis	Lauder- dale	Sun- flower	Tate	Webster	Total	Jefferson Davis	Lauder- dale	Sun- flower	Tate	Webster	Total
Same farm	53	61	52	52	62	280	19	41	33	43	35	171
Same community	52	27	30	30	34	173	40	20	21	23	26	130
Same county	18	23	18	10	19	88	29	56	14	24	19	142
Bordering county	19	3	10	2	7	41	47	6	23	16	7	99
Other Mississippi county	9	11	15	3	8	46	20	9	13	7	16	65
Other state or nation	6	24	13	25	6	74	19	23	11	23	7	83
Total	157	149	138	122	136	702	174	155	115	136	110	690
Percentage distribution												
Same farm	33.8	40.9	37.7	42.6	45.6	39.9	10.9	26.5	28.7	31.6	31.8	24.8
Same community	33.1	18.1	21.7	24.6	25.0	24.6	23.0	12.9	18.3	16.9	23.6	18.8
Same county	11.5	15.4	13.0	8.2	14.0	12.5	16.7	36.1	12.2	17.6	17.3	20.0
Bordering county	12.1	2.1	7.3	1.6	5.1	5.8	27.0	3.9	20.0	11.8	6.4	14.4
Other Mississippi county	5.7	7.4	10.9	2.5	5.9	6.6	11.5	5.8	11.2	5.2	14.5	9.4
Other state or nation	3.8	16.1	9.4	20.5	4.4	10.6	10.9	14.8	9.6	16.9	6.4	12.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

largely by whom she marries, this suggests what was indeed the fact that more tenants' daughters married farmers; and more owners' daughters married men engaged in occupations other than farming.

The fact that more non-owners' children were farming is without doubt due at least in part to the fact that they had less education than did owners' children (Table 47). Non-owners as a rule, had larger families to clothe and

Table 46. Tenure of Parental Family When Sons and Daughters Left School Classified by Occupation

Tenure of parental family	Number of sons				Number of daughters			
	Farming	Non-farming	Part-time farming	Total	Farming	Non-farming	Part-time farming	Total
Owners	247	118	51	416	221	142	34	397
Non-owners	221	55	14	290	232	51	10	293
Total	468	173	65	706	453	193	44	690

Percentage distribution								
Owners	59.4	28.4	12.2	100.0	55.7	35.8	8.5	100.0
Non-owners	76.2	19.0	4.8	100.0	79.2	17.4	3.4	100.0
Total	66.3	24.5	9.2	100.0	65.6	28.0	6.4	100.0

feed than owners and less money with which to do it. As their children grew older and requirements for clothing and school-books increased, they were more likely to permit their young people to quit school to farm or assist in farming. In fact, some of these parents encouraged their sons and daughters to do so. Mrs. J, the wife of an ambitious renter, explained the occupations of her sons thus: "My husband was set on being a landowner and getting on and needed the boys' help to accomplish this goal. They quit school and now they haven't training to do anything except farm."

The reason for keeping children at home to farm was, however, not generally a mere matter of ambition, but of bread and butter. The K family, a cropper family with 12 children, is a good example. Their children stay away from school more than half the time to work on the farm. Two of the boys who had started for themselves were croppers. Naturally so, for this was the work they had done since they were 7 or 8 years old.

Table 47. Tenure of Parental Families of Sons and Daughters Studied at the Time They Left School Classified by Education Received

Education of sons and daughters	Parental families of sons			Parental families of daughters		
	Owners	Non-owners	Total	Owners	Non-owners	Total
	Number	Number	Number	Number	Number	Number
Eighth grade and under	149	214	263	88	147	235
High-school training	158	52	210	158	97	255
High-school graduates	66	18	84	106	45	151
College training	43	6	49	45	4	49
Total	416	290	706	397	293	690

Percentage distribution						
Eighth grade and under	35.8	73.8	51.4	22.2	50.2	34.0
High-school training	38.0	17.9	29.8	39.8	33.1	37.0
High-school graduates	15.9	6.2	11.9	26.7	15.3	21.9
College training	10.3	2.1	6.9	11.3	1.4	7.1
Total	100.0	100.0	100.0	100.0	100.0	100.0

Another factor responsible for the tenant's child having less education is that the mobility of his parental family is greater. The mobility of the family was often spoken of as a reason for children having so little education. "We

went to the Delta and the children stopped school then and never did go back." Remarks such as these were often heard. Mobility is a handicap in the education of children. This was brought out especially in the study made by Sanders of "The Economic and Social Aspects of Mobility of Oklahoma Farmers." He found that the children of the less frequent movers averaged around one-fifth more educational progress per school age year than did the children of more frequent movers.²

The 1930 census showed that of the white farm operators in Mississippi, 63,397 were owners, 930 were managers and 65,448 were tenants. Approximately half of the tenants were croppers.³ As has been shown many of the tenants are younger men and will later become landowners; yet, there are many who are now tenants that will remain so. The large percentage of white farmers in the tenant class presents a problem worthy of the thoughtful consideration of every Mississippian. What can be done to improve the opportunities of boys and girls reared in such homes? This is an important problem not only because of the number of families involved but also because of the large number of children in their families. A bill introduced by Bankhead providing millions of dollars for financing the purchase of small farms in the South by those who now occupy the status of renters and croppers or laborers passed the Senate in 1936. Should this bill also pass the House it will without doubt bring greater vocational opportunities to many a non-owner child. There are, of course, many of our tenant farmers who could not make good on their own farms even if they were able to acquire them. Other provisions must be made for children of such families.⁴ For this lower group, there

Table 48. Tenure History of Parental Families of Sons and Daughters Classified by Occupation

Tenure history of parents	Number of sons				Number of daughters			
	Farming	Non- farming	Part-time farming	Total	Farming	Non- farming	Part-time farming	Total
Of owners:								
Owner always ^a	205	100	40	345	189	129	28	346
Non-owner and owner	42	18	11	71	32	13	6	51
Of non-owners:								
Non-owner always ^a	131	28	7	166	126	29	4	159
Owner and non-owner	82	24	7	113	98	20	6	124
Non-owner on land on which reside but own land elsewhere	8	3	—	11	8	2	—	10
Total	468	173	65	706	453	193	44	690

Percentage distribution

Of owners:								
Owners always ^a	59.4	29.0	11.6	100.0	54.6	37.3	8.1	100.0
Non-owner and owner	59.1	25.4	15.5	100.0	62.7	25.5	11.8	100.0
Of non-owners:								
Non-owner always ^a	78.9	16.9	4.2	100.0	79.2	12.7	8.1	100.0
Owner and non-owner	72.6	21.2	6.2	100.0	79.0	16.1	4.9	100.0
Non-owner on land on which reside but own land elsewhere	72.7	27.3	—	100.0	80.0	20.0	—	100.0
Total	66.3	24.5	9.2	100.0	65.6	28.0	6.4	100.0

^aBy "always" is meant since child started to school.

²J. T. Sanders, *The Economic and Social Aspects of Mobility of Oklahoma Farmers*, Oklahoma Agricultural Experiment Station Bulletin 195 (Stillwater 1929) p. 4.

³U. S. Bureau of the Census *Fifteenth Census of the United States, (1930), Agriculture Summary for the United States 1929 and 30*, p. 35.

⁴About the same proportion of renters' children as children of share croppers entered farming.

should be a program of security with closely supervised education and health work.

It was observed in the preliminary study that quite a number of tenants were former owners; and many owners former tenants. The question naturally came up as to whether the occupational situation of sons and daughters from tenant families who had always been tenants was the same as that of sons and daughters from tenant families who had also been owners, and whether the occupational situation of sons and daughters from owner families who had always been owners was the same as that of sons and daughters from owner families who had also been tenants. For this reason a question concerning the farm history of the parental family was included in the schedule.

Table 48 gives the occupational history of the owner and non-owner families of the three occupational groups. As is indicated, little difference was found between the occupation of the sons of the families who have always been owners and of those who have acquired land more recently. There was slightly more variation in the case of daughters. Those families owning land "always" have doubtless been more stable as to location and could more satisfactorily plan for the future of their children. Owner families who have a tenant history have purchased land more recently. A number were paying for the land when the children were in school, and therefore could not give their children as many opportunities as families whose land was not mortgaged.

The effect upon the occupational situation of the son or daughter of a mortgage on the parental farm is shown in Table 49. As may be noted, daughters were affected more than sons. As has been previously shown, the advanced training of daughters is more frequently financed by the family than that of sons. Consequently, a mortgage would affect the daughter's occupational situation to a greater extent, as it has been shown that daughters with more education were more often employed in non-farm work.

Table 49. Parental Farms With and Without Mortgage at Time Son and Daughter Left School
Classified by Occupation of Sons and Daughters^a

Item	Number of sons				Number of daughters			
	Farming	Non- Part-time		Total	Farming	Non- Part-time		Total
		farming	farming			farming	farming	
Parental farm mortgaged	111	53	21	185	92	50	14	156
Parental farm not mortgaged	136	65	30	231	129	92	20	241
Total	247	118	51	416	221	142	34	397
Percentage distribution								
Parental farm mortgaged	60.0	28.6	11.4	100.0	59.0	32.0	9.0	100.0
Parental farm not mortgaged	58.9	28.1	13.0	100.0	53.5	38.2	8.3	100.0
Total ^b	59.4	28.4	12.2	100.0	55.7	35.8	8.5	100.0

^aFrom owner families only.

^bThere was a 12 per cent disagreement in the replies of family and child as to whether the farm was mortgaged at the time the child left school. However, this disagreement possibly exaggerates inaccuracy, for many of the fathers were present at the interview and they would know, it would seem, if any one did, whether the farm was mortgaged or not.

The children of non-owners who had formerly been owners were found in non-agricultural work more often than children of families who had never owned land. In such families one heard many heart-rending stories of the struggle to keep the farm, and the final defeat and the effect of this upon their children. The experience of L is a good example. L was to graduate

from high school. He put in his order for a class ring and diploma soon after Christmas, making a small cash deposit. The farm was taken over by the Federal Land Bank. L could not raise the money for his diploma and ring. He saw only one solution to his problem—to quit school. This he did two months before graduation time.

It was thought desirable to include a question in the schedule from which the scale of operation on the parental farm could be deduced. Preliminary testing revealed the impracticability of attempting to obtain the number of acres cultivated at the time the child left school. Very few mothers could give this information. The majority were able to state the approximate number of acres of land owned or rented at that time. However, it was observed that the scale of farm operation was often greater on a 120-acre farm than on a 250-acre farm. In some cases much of the land was in woods or pasture. It was, therefore, decided that some other type of information must be obtained to show the scale of operation on the parental farm. It was found that the mother could generally give the number of work animals (mules and horses) and tractors at the time the child left school.⁵ Consequently, these were the measures used to indicate scale of operation. The great majority of sons and daughters in this study came from 2-mule farms (Table 50). Few were sons and daughters of plantation operators. The parents of only seventeen children farmed with tractors, though several in the "8-mule and over" group had purchased tractors since their children left school.

Sons and daughters whose parents had 1 to 5 tractors and 10 or more mules were less likely to be farming than children of 1 or 2-mule farmers (Table 50). With an increase in the scale of operation on the parental farm comes an increase in the power to choose one's vocation. Those who like farming and are adapted to it can farm; those who do not like farming have the means and the

Table 50. Number of Mules and Tractors Worked on Parental Farms of Sons and Daughters Classified by Occupation

Number of mules and tractors worked on parental farm	Number of sons				Number of daughters			
	Non-		Part-time		Non-		Part-time	
	Farming	farming	farming	Total	Farming	farming	farming	Total
1-mule	42	11	5	58	66	16	8	90
2-mules	198	73	18	289	205	66	18	289
3-mules	82	24	13	119	101	34	7	142
4-mules	69	30	9	108	40	29	6	75
5-7 mules	39	16	5	60	29	27	1	57
8-mules and over	32	13	10	55	9	19	4	32
1-5 tractors and 10 or more mules	5	4	5	14	1	2	—	3
Total ^a	467	171	65	703	451	193	44	688

Percentage distribution

1-mule	72.4	19.0	8.6	100.0	73.3	17.8	8.9	100.0
2-mules	68.5	25.3	6.2	100.0	70.9	22.8	6.3	100.0
3-mules	68.9	20.2	10.9	100.0	71.1	24.0	4.9	100.0
4-mules	68.9	27.8	8.3	100.0	53.3	38.7	8.0	100.0
5-7 mules	65.0	26.7	8.3	100.0	50.9	47.4	1.7	100.0
8-mules and over	58.2	23.6	18.2	100.0	28.1	59.4	12.5	100.0
1-5 tractors and 10 or more mules ^b	35.7	28.6	35.7	100.0	33.3	66.7	—	100.0
Total	66.4	24.3	9.3	100.0	66.1	27.5	6.4	100.0

^aSons and daughters of managers and non-cash farm assistants were not included in this tabulation.

^bNo family had a tractor who did not also own 10 or more mules.

⁵The number of tenant families was another measure of farm operation used. This measure, however, was not as good a gage for the composition of the parental family acts as a disturbing factor. Families with several grown sons would not need tenant families.

opportunity of entering some other kind of work. Farming is thus, for those whose parental families farm extensively, one of the many occupations which they can follow; for those whose parental families have a 1 or 2-mule farm it is about the "only thing there is to do." It is for the majority not a freely chosen occupation, but an occupation which is the result of "under-privilege."⁶

The Price of Cotton at the Time the Child Left School

The general economic condition in the state the year in which or the year after, the child left school might be considered a probable factor in the occupational situation of these farm children. The relative price of cotton and cotton seed was thought to be a better measure than any other of this condition, since cotton was the main cash crop of the families concerned. Indexes of the price of cotton and cotton seed were not available for any year before 1910. A few of the children in the study left school before 1910. The price per pound received by cotton producers of the United States can be obtained, however, for any year since 1890.⁷ It was decided, therefore, to use these prices in constructing the index numbers; for Mississippi is one of the leading cotton-producing states and, therefore, helps to set the price of cotton.⁸

A tabulation classifying the sons and daughters into three occupational groups on the basis of the price of cotton the year they left school will not show the actual relation between these two factors because age enters in as a disturbing factor. The majority of those leaving school when the index price of cotton was 106 and under left during the present business depression and are consequently also the younger sons and daughters. On the other hand, the index price of cotton has not been 201 or over since 1924. This means that the majority leaving during a high cotton price index were of the older group. It has been shown that the younger group are more likely to be farming than are the older group. For this reason each price index group is broken up into age groups. In no other way can one have a real basis for comparison. Breaking the tabulation up into so many groups, however, limits the number of cases in each.

There is one other condition in addition to the limited number of cases which makes the classification of the three occupational groups by price index of cotton the year they left school of doubtful value; that is, the fact that 15 per cent of the families disagreed with the school records as to the date their children left school.⁹ The tabulation is given, nevertheless, for it seems to confirm the fact that one of the results of poor economic conditions is a larger number of farmers. Sons and daughters 19 to 23 years of age, who left school when cotton prices were low, medium and high did not vary greatly in their occupations; that is, whether they were farming or non-farming pursuits (Table 51). Those 29 to 33 years of age who left school when cotton prices were low were more frequently farmers.

The variation in the proportion of sons found in the three occupational groups with low, medium and high price indexes of cotton the year after they left school was not as great as for the year they left school. This would indicate that even if the price of cotton did rise the next year, there would possibly be some who would continue to farm who, if conditions had been better the

⁶However, in this respect farming is like many other occupations. Yet, the fact remains that there should be more opportunity for choice.

⁷U. S. Department of Agriculture, *Yearbook of Agriculture* (1934), p. 450.

⁸For index numbers of cotton prices from 1900-34, see Table 127, p. 129.

⁹Although only 83 per cent of the dates of leaving school obtained from school records agreed with information furnished by the family only 15 per cent of the sons or daughters would have been placed in a different "price index of cotton" group if they had been classified according to the information received from the school rather than from the family.

year they left school, would now be engaged in non-agricultural pursuits; or, conversely, that if economic conditions became worse the next year, those who were non-farming or planning to enter non-farm occupations would continue with their plans. It takes some time, of course, for a change in the price of cotton to have an effect on the occupational situation. During business depression many sons and daughters are forced into farming. Some form obligations which later, when times get better, make changing their occupation impractical, even should they desire it. Thus there will be more sons and daughters farming in 1944 from the group leaving school in 1931, 1932, and 1933 than there would have been had there been no low price cotton during these years.¹⁰

Table 51. Price Index of Cotton the Year Sons and Daughters Left School
Classified by Occupation

Present age and price index of cotton when leaving school	Number of sons				Number of daughters			
	Farming	Non- Part-time		Total	Farming	Non- Part-time		Total
		farming	farming			farming	farming	
106 and under.....	101	23	9	136	130	38	13	181
19-23 years.....	89	16	6	111	120	33	13	166
24-28 years.....	6	8	2	16	7	3	—	10
29-33 years.....	6	2	1	9	3	2	—	5
107-200.....	254	96	37	387	223	110	20	353
19-23 years.....	121	18	8	147	84	27	4	115
24-28 years.....	107	51	15	173	102	54	11	167
29-33 years.....	26	27	14	67	37	29	5	71
201 and over.....	113	51	19	183	100	45	11	156
19-23 years.....	8	1	1	10	3	—	—	3
24-28 years.....	59	17	6	82	48	10	5	63
29-33 years.....	46	33	12	91	49	35	6	90
Total.....	468	173	65	706	453	193	44	690

Percentage distribution

106 and under.....	74.3	19.1	6.6	100.0	71.8	21.0	7.2	100.0
19-23 years.....	80.2	14.4	5.4	100.0	72.3	19.9	7.8	100.0
24-28 years.....	37.5	50.0	12.5	100.0	70.0	30.0	—	100.0
29-33 years.....	66.7	22.2	11.1	100.0	60.0	40.0	—	100.0
107-200.....	65.6	24.8	9.6	100.0	63.2	31.2	5.6	100.0
19-23 years.....	82.3	12.2	5.5	100.0	73.0	23.5	3.5	100.0
24-28 years.....	61.8	29.5	8.7	100.0	61.1	32.3	6.6	100.0
29-33 years.....	38.8	40.3	20.9	100.0	52.1	40.9	7.0	100.0
201 and over.....	61.7	27.9	10.4	100.0	64.1	28.8	7.1	100.0
19-23 years.....	80.0	10.0	10.0	100.0	100.0	—	—	100.0
24-28 years.....	72.0	20.7	7.3	100.0	76.2	15.9	7.9	100.0
29-33 years.....	50.5	36.3	13.2	100.0	54.4	38.9	6.7	100.0
Total.....	66.3	24.5	9.2	100.0	65.5	28.0	6.4	100.0

The Probability of Inheriting Land

A question asking whether "land or capital had been inherited" was included in the preliminary schedule. It was found, however, that in the majority of cases the parents were living, and the property had not been divided among the children. A question concerning the number of acres on the parental farm was, therefore, substituted and from this the acreage per child of those who will inherit was worked out.¹¹ It was thought that such data would indicate something of the probability of inheriting.

¹⁰This may not, of course, be the case should the government regulate in the future the number in the various occupations as it now does the amount of cotton, tobacco, and hogs produced. There seems to be no more reason for controlling the amount produced than there is for controlling the number producing it.

¹¹The number of acres which the child will inherit is, of course, not as good a gage as the value of land to be inherited, for some of the land owned is unfit for cultivation. However, the number of acres owned is a fact which can be secured more accurately than the value of land owned and for this reason acreage was used.

As may be noted from Table 52, sons and daughters for whom the acreage per child was lowest were most likely to be found in farm occupations. Sons in the other four acreage groups did not show much variation as to the proportion farming. Daughters, however, in the highest acreage group were least likely to be found in farm occupations. In other words, daughters of large land owners receive more education and are thus more likely to obtain non-farming work and to marry men engaged in non-agricultural pursuits. Farming is an occupation followed in this state in the main by children of small land owners and non-owners.

Table 52. Number of Acres per Child Owned by Parental Families of Sons and Daughters Classified by Occupations of Sons and Daughters^a

Acreage per child	Number of sons				Number of daughters			
	Farming	Non- Part-time		Total	Farming	Non- Part-time		Total
		farming	farming			farming	farming	
Under 10 acres.....	42	12	5	59	52	20	6	78
10-24 acres.....	98	58	15	171	86	57	14	157
25-49 acres.....	51	24	16	91	53	35	7	94
50-99 acres.....	34	12	10	56	21	15	4	40
100 acres or over.....	22	12	5	39	10	15	3	28
Total.....	247	118	51	416	221	142	34	397
Percentage distribution								
Under 10 acres.....	71.2	20.3	8.5	100.0	66.7	25.6	7.7	100.0
10-24 acres.....	57.3	33.9	8.8	100.0	54.8	36.3	8.9	100.0
25-49 acres.....	56.0	26.4	17.6	100.0	55.3	37.2	7.5	100.0
50-99 acres.....	60.7	21.4	17.9	100.0	52.5	37.5	10.0	100.0
100 acres or over.....	56.4	30.8	12.8	100.0	35.7	53.6	10.7	100.0
Total.....	59.4	28.4	12.2	100.0	55.7	35.8	8.5	100.0

^aThis tabulation is, of course, limited to owners' children and includes only those who will inherit.

Recreational Facilities Provided by the Home

In the initial plans for the study, a rural-home-equipment-score card including items such as running water in the home, electric lights in the home, and other labor-saving and health-conserving equipment was included. After some thought and further investigation it was decided to discard this idea (as most of the rural families of Mississippi would fall in one category thus making comparisons impossible)¹² and to substitute three questions concerning recreational facilities furnished by the parental home. The three questions selected were: (1) whether the parental family had a dining room and living room not ordinarily used for other purposes; (2) whether they had an auto; and (3) whether they had subscribed to a daily paper at the time the child left school. Preliminary study had shown that the difference between the number having and not having these items would be large enough to justify comparison of the two groups.

Of the farming sons and daughters more came from parental families who did not have an auto at the time they left school, than came from families who did (Table 53). This difference, though small in the case of boys, was much greater among girls. Boys can more easily "bum rides" to the city and seek out non-farm work. There were relatively fewer farming sons and

¹²The 1930 census figures show that 1.8 per cent of the farm homes in Mississippi have water piped into the houses; 1.5 per cent are lighted by electricity. In some cases lack of labor-saving equipment is due to absence of such facilities as commercial electric lines and public-water systems; in some cases to economic and cultural factors within the household. This is another reason why data on home equipment were not obtained, for including such data would have necessitated securing still further information, the value of which would, it was believed, not have warranted the time and energy involved.

Table 53. Recreational Facilities Provided by Parental Families of Sons and Daughters
Classified by Their Occupation

Recreational Facilities	Number of sons				Number of daughters			
	Farming	Non- farming	Part-time farming	Total	Farming	Non- farming	Part-time farming	Total
Auto	186	77	25	288	149	100	17	266
No auto	282	96	40	418	304	93	27	424
Room other than kitchen not slept in	222	112	45	379	212	139	23	374
No room other than kitchen not slept in	246	61	20	327	241	54	21	316
Daily paper	161	93	31	285	122	104	15	241
No daily paper	307	80	34	421	331	89	29	449
All of these items	97	48	17	162	61	75	8	144
None of these items	180	44	14	238	178	39	17	229
One or two of these items	191	31	34	306	219	79	19	317

Percentage distribution

Auto	64.6	26.7	8.7	100.0	56.0	37.6	6.4	100.0
No auto	67.5	22.9	9.6	100.0	71.7	21.9	6.4	100.0
Room other than kitchen not slept in	58.6	29.6	11.8	100.0	56.7	37.2	6.1	100.0
No room other than kitchen not slept in	75.2	18.7	6.1	100.0	76.3	17.1	7.1	100.0
Daily paper	56.5	32.6	10.9	100.0	50.6	43.2	6.2	100.0
No daily paper	72.9	19.0	8.1	100.0	73.7	19.8	6.5	100.0
All of these items	59.9	26.6	10.5	100.0	42.4	52.1	5.5	100.0
None of these items	75.6	18.5	5.9	100.0	75.6	17.0	7.4	100.0
One or two of these items	62.4	26.5	11.1	100.0	69.1	24.9	6.0	100.0

daughters whose parental family had a dining or living room and who took a daily paper at the time they left school than were from the group whose parental family did not have these items. The difference was somewhat greater in the case of girls.

Of the non-farming sons, 11 per cent more came from parental families who possessed the three items than came from those who did not. An auto, a dining or living room, and a daily paper depended for the most part on the economic conditions of the parental family. Owner families more frequently had these items than did non-owner families. Therefore, one would expect to find the children from families in which these facilities were not provided more often farming, and to find girls more affected than boys since the occupational careers of daughters were more dependent than sons on ownership of land.¹³ In spite of the fact that there was a fairly high disagreement in the replies of the children and the family concerning possession of these items, 9 per cent for the auto and 16 per cent for the other two items, it is believed that the difference in the group having and that not having them is significant. In the first place, all evidence points to the fact that these were among the questions more often incorrectly answered by the child and that in many cases of disagreement the family's reply was without doubt the right reply; in the second place, the differences in the proportion found in farming, non-farming, and part-time farming, was too large to be ascribed entirely to inaccuracy.

It can be concluded from the data presented that the financial status of the parental family has more effect on the daughter than it does on the son. In other words, that the girl is more dependent on the economic resources of her family than is her brother. It would, therefore, seem that there is a

¹³Table 46, p. 47.

special need for additional vocational opportunities being provided for girls of the poorer rural families.

Facilities Provided by the Community for Getting to School

Table 54 shows the effect upon education when transportation to a four-year high school is furnished; in districts in which transportation was furnished a larger proportion of the children were graduates of a four-year high school. Boys living in districts with transportation furnished more frequently had "high-school training." The proportion of daughters with "high-school training" in the two locations was about the same. Families frequently spoke of the difficulty of getting sons to attend the old type of school of nine or ten grades. Repeatedly they said, "our boys saw no need for such an education and so dropped out." A number spoke of the increased interest in schooling of boys since the advent of four-year Smith-Hughes schools and a good system of transportation.

The fact that the girls living in districts in which transportation was not furnished attended college more frequently can be explained by the fact that formerly when transportation was rarely furnished to a high school many girls paid their way through college from savings derived from teaching school in rural districts. Since the standard for teachers has been raised this opportunity no longer exists.

A number of instances were encountered where the careers of boys and girls had been apparently changed for the worse because communities did not provide the proper facilities for getting an education. Mrs. P, for instance, had a very bright daughter who liked to go to school. The family moved to a neighborhood where transportation was not furnished to high school. Some of the children from the more prosperous homes went in cars or boarded in dormitories, but the P family could barely exist and could not pay for transportation for their daughter. Q cried when she discovered that her family had moved where there was no bus to high school, and she would be unable to get an education. She secured a job as a companion and recently married. Mrs. P feels very uncertain about her new son-in-law. "If Q had just had an opportunity, she wouldn't have married this way," said Mrs. P. In another case, the community school had ten grades only. All of R's friends went to town to finish high school. R's family could not afford to send her. "She married for want of something better to do," says her mother.

Table 54. Number and Proportion of Sons and Daughters Studied with Transportation to a Four-year High School Classified by Education Received

Education	Number of sons			Number of daughters		
	Transportation furnished ^a	Transportation not furnished	Total	Transportation furnished	Transportation not furnished	Total
Eighth grade and under	178	182	360	112	128	240
High-school training	135	72	207	157	98	255
High-school graduate	69	12	81	125	17	142
College training	34	17	51	25	24	49
Total	416	283	699	419	267	686
Percentage distribution						
Eighth grade and under	42.8	64.3	51.5	26.7	47.9	35.0
High-school training	32.4	25.4	29.6	37.5	36.7	37.2
High-school graduate	16.6	4.2	11.6	29.8	6.4	20.7
College training	8.2	6.1	7.3	6.0	9.0	7.1
Total	100.0	100.0	100.0	100.0	100.0	100.0

^aSeveral parents did not know whether or not transportation had been furnished.

4-H Club Membership

It seemed desirable to include in this report a discussion of the relationship of at least one social organization to type of occupation pursued. The 4-H Club, a club whose aim is to promote more intelligent agriculture and farm homemaking was chosen for this purpose.

Membership in the 4-H Club is open to all. However, as is shown in Table 55 owners' children are somewhat more likely to take advantage of the organization. Owner parents have better education and broader contacts. Thus there is a more friendly soil for the teaching of those who might be a possible source of aid to their children. Then, too, children of owners attend school longer and as the clubs are usually organized and meetings conducted in the school, naturally there would be more members from owner families. In the third place, owner families, as a rule, have more money available to purchase project materials. 4-H Club work affords an opportunity to make money. A few of the boys and girls in this study used the money they realized from 4-H Club projects for financing a college education. M, for instance, belonged to the "tomato club" and earned enough money canning to send herself to college. She then helped with the college expenses of a sister.

About one-fourth of the sons and daughters had been club members (Table 56). The proportion of daughters who had been club members was somewhat greater than the proportion of sons. Many of these farm children, of course, did not have an opportunity to become a 4-H Club Member. As has been stated, in some of the counties agricultural and home agents had not been provided regularly. The proportion of farming sons and daughters, who had not been members of a 4-H Club, was somewhat greater than for those who had been members. The difference is greater in the case of daughters than

Table 55. Members and Non-Members of the 4-H Club Classified by Tenure of Parental Family

Tenure of parental family	Number of sons			Number of daughters		
	Members 4-H Club	Non-members 4-H Club	Total	Members 4-H Club	Non-members 4-H Club	Total
Owners	106	310	416	115	282	397
Non-owners	53	236	289	65	226	291
Total ^a	159	546	705	180	508	688
Percentage distribution						
Owners	25.5	74.5	100.0	29.0	71.0	100.0
Non-owners	18.3	81.7	100.0	22.3	77.7	100.0
Total	22.6	77.4	100.0	26.2	73.8	100.0

^aRecords were not obtained of 3 children.

Table 56. Members and Non-Members of the 4-H Club Classified by Type of Occupation

Item	Number of sons				Number of daughters			
	Farming	Non-farming	Part-time farming	Total	Farming	Non-farming	Part-time farming	Total
Member of 4-H Club	102	42	12	156	108	60	14	182
Not a member of 4-H Club	365	131	53	549	343	133	30	506
Total	467	173	65	705	451	193	44	688
Percentage distribution								
Member of 4-H Club	65.4	26.9	7.7	100.0	59.3	33.0	7.7	100.0
Not a member of 4-H Club	66.5	23.9	9.6	100.0	67.8	26.3	5.9	100.0
Total	66.3	24.5	9.2	100.0	65.6	28.0	6.4	100.0

in the case of sons. This is due probably to the fact that more owners' children are 4-H Club members.

The relationship of the type of occupation followed to membership in a 4-H Club would thus seem to be little, if any.¹⁴ The 4-H Club probably wields its main influence in other ways than influencing the rural child to adopt this or that occupation. That this is true is indicated by two letters received from children in the study. Mrs. N. writes, "I stayed home for two or three years after leaving school and had a club patch and did a lot of canning, which earned some money. I've been married five years and have been living in X. We rent an apartment, but we have had a garden every year with the exception of one. I can a great deal each year." Another writes, "I am working 23 acres of land this year, eleven and a half acres of cotton, eleven and a half acres of corn, besides my peas, potatoes, peanuts and sorghum, making a total of about 25 acres. I still have a membership in the 4-H Club. I have had a membership for 10 years and keep a record every year. I enjoy farming better than any work I ever did. I also enjoy handling stock of any kind. I was raised on a farm and never left it until I married in 1927. Since that time I have done various kinds of work, but I enjoy farming best."

Urban Experience

The last group of socio-economic factors to be considered is the urban experience of the son or daughter at the time of leaving school. In what type of county were they residing at that time, one with a large town or city or one with small villages only? How near were they to a town of 1000 inhabitants? A city of 10,000 inhabitants? Had they ever been in a town of 2500 inhabitants before they left school? Had they spent the night in a town of 2500 inhabitants before this time? An answer to these questions is important for undoubtedly children who have not been subjected to the influence of a city or town are less likely to seek it out; they are more likely to remain on the home farm or on some other farm nearby.

At the time of leaving school the parental families were scattered over 42 counties of the State, but the majority were in the same five in which they

Table 57. County of Residence of Sons and Daughters at the Time of Leaving School Classified by Occupation^a

County of residence	Number of sons				Number of daughters			
	Non-		Part-time		Non-		Part-time	
	Farming	farming	farming	Total	Farming	farming	farming	Total
Jefferson Davis	100	12	13	125	104	38	6	148
Lauderdale	75	49	3	127	85	50	9	144
Sunflower	56	30	8	94	55	34	8	97
Tate	65	45	11	121	76	45	9	130
Webster	82	16	20	118	76	16	8	100
Total	378	152	55	585	396	183	40	619
Percentage distribution								
Jefferson Davis	80.0	9.6	10.4	100.0	70.3	25.7	4.0	100.0
Lauderdale	59.1	38.6	2.3	100.0	59.0	34.7	6.3	100.0
Sunflower	59.6	31.9	8.5	100.0	56.7	35.1	8.2	100.0
Tate	53.7	37.2	9.1	100.0	58.5	34.6	6.9	100.0
Webster	69.5	13.6	16.9	100.0	76.0	16.0	8.0	100.0
Total	64.6	26.0	9.4	100.0	64.0	29.6	6.4	100.0

^aOnly counties in which there were ten sons and ten daughters reported here.

¹⁴There was a 13 per cent disagreement found in the replies of the family and the children concerning previous membership in a 4-H Club. It is thought that in the majority of cases of disagreement, the child's reply was the correct reply. However, in the majority of cases in which there was disagreement, the affiliation of the son or daughter with the 4-H Club had been probably so "luke warm" that the influence was doubtless nil.

resided in 1934. The percentage distribution of the three occupational groups living in these five counties at the time of leaving school is given in Table 57. The counties of residence of all sons and daughters at that time are given in the Appendix.¹⁵ Sons and daughters who were living in Lauderdale, Tate, and Sunflower Counties at the time they left school were more likely to be engaged in non-farm pursuits than those living in Jefferson Davis and Webster Counties. Jefferson Davis and Webster Counties are the most rural counties of the group, having no town of 2500 inhabitants. Lauderdale County has Meridian. Tate County is in close vicinity to Memphis, Tennessee. Sunflower County has several fairly large towns, of which Indianola, with a little over 3000 inhabitants, is the largest. Less non-farm work was, therefore, available for children of Webster and Jefferson Davis Counties.

Table 58. Distance from a Town of 1000 Inhabitants of Sons and Daughters at the Time They Left School Classified by Occupation

Distance to town of 1000 inhabitants	Number of sons				Number of daughters			
	Farming	Non- farming	Part-time farming	Total	Farming	Non- farming	Part-time farming	Total
5 miles or nearer.....	36	28	6	70	56	28	7	91
6-10 miles	107	40	13	160	77	39	7	123
11-15 miles	133	52	18	203	126	58	17	201
16-20 miles	122	46	21	189	136	58	11	205
21-25 miles	41	3	3	47	24	4	—	28
26-30 miles	20	3	3	26	18	1	—	19
31 miles and over.....	9	1	1	11	16	5	2	23
Total	468	173	65	706	453	193	44	690
Percentage distribution								
5 miles or nearer.....	51.4	40.0	8.6	100.0	61.5	30.8	7.7	100.0
6-10 miles	66.9	25.0	8.1	100.0	62.6	31.7	5.7	100.0
11-15 miles	65.5	25.6	8.9	100.0	62.7	28.8	8.5	100.0
16-20 miles	64.6	24.3	11.1	100.0	66.3	28.3	5.4	100.0
21-25 miles	87.2	6.4	6.4	100.0	85.7	14.3	—	100.0
26-30 miles	77.0	11.5	11.5	100.0	94.7	5.3	—	100.0
31 miles and over.....	81.8	9.1	9.1	100.0	69.6	21.7	8.7	100.0
Total	66.3	24.5	9.2	100.0	65.6	28.0	6.4	100.0

Table 59. Distance from a City of 10,000 Inhabitants of Sons and Daughters at the Time They Left School Classified by Occupation

Distance to city of 10,000 inhabitants	Number of sons				Number of daughters			
	Farming	Non- farming	Part-time farming	Total	Farming	Non- farming	Part-time farming	Total
10 miles and less.....	11	7	1	19	9	6	1	16
11-20 miles	71	47	10	128	80	41	8	129
21-30 miles	50	9	5	64	45	16	4	65
31-40 miles	133	38	19	190	130	63	10	203
41-50 miles	60	33	9	102	58	26	9	93
51-60 miles	79	27	16	122	82	22	7	111
61-70 miles	39	6	5	50	39	16	4	59
71 miles and over.....	25	6	—	31	10	3	1	14
Total	468	173	65	706	453	193	44	690
Percentage distribution								
10 miles and less.....	57.9	36.8	5.3	100.0	56.2	37.5	6.3	100.0
11-20 miles	55.5	36.7	7.8	100.0	62.0	31.8	6.2	100.0
21-30 miles	78.1	14.1	7.8	100.0	69.2	24.6	6.2	100.0
31-40 miles	70.0	20.0	10.0	100.0	64.1	31.0	4.9	100.0
41-50 miles	58.8	32.4	8.8	100.0	62.4	27.9	9.7	100.0
51-60 miles	64.8	22.1	13.1	100.0	73.9	19.8	6.3	100.0
61-70 miles	78.0	12.0	10.0	100.0	66.1	27.1	6.8	100.0
71 miles and over.....	80.6	19.4	—	100.0	71.4	21.4	7.1	100.0
Total	66.3	24.5	9.2	100.0	65.6	28.0	6.4	100.0

¹⁵Table 128, p. 130.

As may be noted, there was a greater proportion of the farming sons and daughters who lived a great distance from a town (Table 58 and 59). Children who live far from town visit it less frequently and are consequently less subjected to non-farm experience; for the town is the seat of non-farm occupations.¹⁶ Not only are visits in town important but overnight visits in which the son and daughter come more directly in touch with electric lights, a modern plumbing system, and other conveniences commonly had by town families of the State. Children having had such experience are more likely to be in non-farm occupations.¹⁷

Table 60. Urban Experience of Sons and Daughters Before Leaving School
Classified by Occupation

Urban experience before leaving school	Number of sons				Number of daughters			
	Farming	Non-farming	Part-time farming	Total	Farming	Non-farming	Part-time farming	Total
Visited town of 2500 inhabitants or more.....	375	163	55	593	372	183	34	589
Not visited town of 2500 inhabitants or more	92	10	10	112	79	10	10	99
Visited town of 2500 inhabitants or more overnight	213	129	34	376	208	140	20	368
Not visited town of 2500 inhabitants or more overnight	254	44	31	329	243	53	24	320
Attended school in town less than 2500 inhabitants	461	169	64	694	445	184	41	670
Attended school in town more than 2500 inhabitants	6	4	1	11	6	9	3	18
Percentage distribution								
Visited town of 2500 inhabitants or more	63.2	27.5	9.3	100.0	63.1	31.1	5.8	100.0
Not visited town of 2500 inhabitants or more	82.2	8.9	8.9	100.0	79.8	10.1	10.1	100.0
Visited town of 2500 inhabitants or more overnight	56.6	34.3	9.1	100.0	56.5	38.1	5.4	100.0
Not visited town of 2500 inhabitants or more overnight	77.2	13.4	9.4	100.0	75.9	16.6	7.5	100.0
Attended school in town less than 2500 inhabitants	66.4	24.4	9.2	100.0	66.4	27.5	6.1	100.0
Attended school in town more than 2500 inhabitants	54.5	36.4	9.1	100.0	33.3	50.0	16.7	100.0

CHAPTER VII.

FARMING SONS AND DAUGHTERS

In this and the two succeeding chapters the occupational histories of the sons and daughters included in the study are presented in some detail. This

¹⁶There was a disagreement of 7 per cent in the replies of the family and child as to approximate distance from town. See Appendix, p. 110, for an explanation of the meaning of approximate distance.

¹⁷One would, of course, not be subjected to much urban influence in one overnight visit in a town of 2500 inhabitants. However, in the preliminary testing it was found that the family answered even less accurately an inquiry as to whether the child had spent a week or two weeks in a town of 2500 inhabitants. The majority of the sons and daughters who had spent a night in a town of 2500 inhabitants paid a longer visit than one night.

chapter deals with the farming group; Chapter VIII with those in non-farming occupations; and Chapter IX with those who were farming and also carrying on other occupations.

Farming Sons

Of the 451 sons engaged in farming at the time of the study only 30 were land-owners. The majority of these were one-mule or small scale farmers.¹ Seventeen had inherited their farm. Most of these sons were from Jefferson Davis and Webster Counties where land was often deeded to the child at the time he left school, or more frequently when he married. In Webster County where the ratio of taxes to value of land was higher than in any other County studied, land was often deeded to the child in order to shift some of the burden of taxation.² Thirteen of the 30 landowning sons had a mortgage on their land.³ This is relatively somewhat less than the proportion of parental farms mortgaged, but this is to be expected for over half the sons had recently inherited their farms. Sons of the post-war period have not been able to ascend the "agricultural ladder" to ownership with the rapidity of their fathers. High land values, high taxes, and low price cotton in comparison with prices of manufactured commodities have made it more and more difficult to acquire and retain land. Farming is the most available vocation for this group of farm children, but farm ownership is a goal which is increasingly within the reach of few.⁴

The second group of farm operators, a group smaller even than that of owners, is managers. The majority of managers were living in Sunflower County, most of them managing farms for their parental families. Managers compose one of the smallest tenure groups in Mississippi, as well as in this study, for they are employed generally only on the large plantations.

Table 61. Farm Tenure and Financial Status of Sons Actively Engaged in Farming

Farm tenure and financial status ^a	Number	Per cent
Farm operators	278	61.7
Owners	30	6.7
Farm mortgaged	13	2.9
Farm not mortgaged	17	3.8
Managers	10	2.2
Tenants	238	52.8
Relatives' land rented	85	18.8
Own work stock	55	12.2
Do not own work stock	30	6.7
Non-relatives' land rented	153	33.9
Own work stock	104	23.1
Do not own work stock	49	10.3
Farm laborers	173	38.3
Wage workers	77	17.1
Work for relatives	64	14.2
Do not work for relatives	13	2.9
Non-cash assistants	96	21.4
Total	451	100.0

^aThere was a 10 per cent disagreement in the replies of family and farming sons as to farm tenure.

¹The disagreement in the replies of the parents and farming sons as to the number of mules worked was 10 per cent. However, the percentage of sons failing to answer this question was high. See Appendix, p. 110.

²In 1930, the ratio of taxes to value of land in Webster County was 3.29, in Jefferson Davis County, 2.24, in Lauderdale County, 1.74, in Sunflower County, 2.25, and in Tate County, 2.83. See U. S. Bureau of the Census, *Fifteenth Census of the United States (1930), Agriculture, Mississippi*, pp. 31-33.

³There were only 11 owner sons who returned the questionnaire. Therefore, a check on the agreement in the replies of the sons and family is not very significant. In four cases the parents' and sons' replies disagreed.

⁴This tendency will without doubt be reversed should the Government make it possible to obtain good land at moderate prices with convenient terms of payment.

Table 62. Number of Mules Worked by Operator Sons Who Were Owners and Tenants Classified by Tenure^a

Number of mules worked	Form of tenure					
	Owners		Tenants		All sons	
	Number	Per cent	Number	Per cent	Number	Per cent
1 mule	18	60.0	198	83.2	216	80.6
2 mules	8	26.7	34	14.3	42	15.6
3-4 mules	3	10.0	2	.8	5	1.9
5 mules and over	1	3.3	4	1.7	5	1.9
Total	30	100.0	238	100.0	268	100.0

^aManagers were not included in this tabulation as it was thought they were not comparable in this respect with owners and tenants.

Table 63. Method by Which Owner Sons Obtained Their Farms

Method of obtaining farms	Number
Inherited	17
Purchased	13
Total	30

The third group of farm operators, and the largest group is tenants (Table 61). They are classified into two groups according to whether they (1) rent relatives' land or (2) rent non-relatives' land. Young men often subrent from their kin. In this tabulation, those sub-renting from relatives were not counted as renting relatives' land, for non-owner relatives, as a rule, do not give their kin any better terms than the landlord gives them. They are usually merely intermediaries. "When you see Mr. O, Dad, get some land for me, too." In such a way the sons usually strike their bargains. Young men renting land from their relatives, on the other hand, often secure it by paying taxes. If the crop is a failure, they are not so likely to be replaced or pressed for their debts. Therefore, their economic status is more favorable than young men renting land from those who are not related to them. In this study about one-third of the tenants rented from kin.

About two-thirds of both groups, those renting from kin and not renting from kin, owned their work stock. Those who own their work stock can usually secure more favorable terms than those who must depend on the landlord to furnish the stock. This is not altogether true in the case of those renting from relatives, but it is certainly true of those who rent land from those not related to them; for the group without stock must become the lowest class of farm operator, "a man working on halves," better known as a cropper.

Those engaged in farming who are not operators are the farm laborers, wage workers and non-cash assistants. As in the case of tenants, wage workers were also classified as to whether or not they worked for relatives. As may be noted, the great majority do work for relatives. The wage worker in this study is usually a young man working on the family farm with a definite financial agreement with his family. Non-cash assistants⁵ are those who work on the family farm without a definite financial agreement. There are a number of reasons why young men are willing to remain at home under such conditions: (1) Some hope to inherit the land; (2) The majority have nowhere to go. They have not sufficient training or experience to secure other work. (3) Many who enjoy farming would like a farm of their own, but can find no farm available near enough to live at home. The majority of non-cash assistants are single; and since operating a farm without a woman's help is difficult, few attempt it.

⁵These sons are classified as "Unpaid family workers" in census reports.

How many of these farmers find occasional work off the farm? Very few had found any supplementary work during the past year (Table 64). Managers had had none while about one-fourth of the owners had had some work.⁶ Common labor was the work most frequently secured, machine and related trades the next. Since the depression supplementary work has been difficult to secure. Many who depended formerly on "odd" jobs for much of their cash income have been unable to secure any during the last year or so.

Table 64. Supplementary Non-farm Occupations of Farming Sons Classified by Their Tenure

Supplementary non-farm Occupations	Form of tenure				
	Owners	Managers	Tenants	Wage workers	Non-cash assistants
	Number	Number	Number	Number	Number
Common labor	2	—	25	4	9
Machine and related trades ..	4	—	3	—	—
Driver and carrier	1	—	3	—	2
Factory operator and laborer ..	—	—	2	—	1
Supervisory service	1	—	—	—	—
No supplementary occupation ..	22	10	205	73	83
Total	30	10	238	77	95

Percentage distribution					
Common labor	6.7	—	10.5	5.2	9.5
Machine and related trades ..	13.4	—	1.3	—	—
Driver and carrier	3.3	—	1.3	—	2.1
Factory operator and laborer ..	—	—	.8	—	1.0
Supervisory service	3.3	—	—	—	—
No supplementary occupation ..	73.3	100.0	86.1	94.8	87.4
Total	100.0	100.0	100.0	100.0	100.0

A little over one-half of the farming sons (53 per cent) were living at home. About 10 per cent of these were taking their father's place, 30 per cent were assisting on the farm, and 60 per cent were independent farmers; that is, tenants or wage workers. Sons of owners were more often farming independently than were sons of tenants. Tenant families were large and competition for the dollars earned was probably keener than in the case of owner families. As one father aptly put it, "I plan to give my son a bale of cotton, but never do, for when the time comes to settle up, I need the cotton to pay my bills."

Table 65. Occupational Status of Farming Sons Living at Home Classified by Tenure of Parental Family in 1934

Occupational status of farm sons in their families	Tenure of parental family					
	Owners		Tenants		All families	
	Number	Per cent	Number	Per cent	Number	Per cent
Takes fathers place	12	11.3	12	9.1	24	10.2
Assists family	22	20.8	47	35.6	69	28.9
Independent farmer	72	67.9	73	55.3	145	60.9
Total	106	100.0	132	100.0	238	100.0

Just as there are certain factors that explain, at least in part, why the son is farming or not farming, so there are factors that explain why the farm son is an owner or a tenant, or the non-farm son in professional services or common labor. Age, marital status, present tenure and residence of the parental family, spatial mobility, and occupational history are some of the factors which will be examined as probably related to the present tenure situation of the farming sons.

⁶The disagreement in data on this question obtained from the family and the farming sons was high (17 per cent). See Appendix A, p. 114.

Table 66. Ages of Farming Sons Classified by Tenure^a

Tenure of sons	Sons of specified age							
	19-23 years		24-28 years		29-33 years		All sons	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Owners	4	1.9	18	10.9	8	10.4	30	6.8
Managers	5	2.4	4	2.4	1	1.3	10	.8
Tenants	84	40.2	99	60.0	55	71.4	238	52.8
Wage workers	52	24.9	19	11.5	6	7.8	77	17.9
Non-cash assistants	64	30.6	25	15.2	7	9.1	96	21.7
Total	209	100.0	165	100.0	77	100.0	451	100.0

^aThere was a 10 per cent disagreement in the replies of family and farming sons as to age group.

Wage workers and non-cash assistants or those in the farm-laborer group were more frequently the younger sons; owners and tenants more frequently the older sons (Table 66). One may consequently assume that the majority of our farmers are laborers before they become operators, in other words, the farm laborer is on a "lower rung" of the "agricultural ladder" than is the farm operator. Managers were also a younger group. Some of these boys are the sons of planters who had placed them in charge of all or part of the family plantation since the sons had not been able to obtain a position after leaving college. Ninety-four percent of the married sons were farm operators, while only 25 percent of the unmarried sons were operators. Many of the sons live at home and farm with their fathers until they marry, at which time the majority become farm operators.

Table 67. Married and Unmarried Farming Sons Classified by Their Tenure

Tenure of sons	Married sons		Unmarried sons		All sons	
	Number	Per cent	Number	Per cent	Number	Per cent
Owners	30	12.4	—	—	30	6.8
Managers	9	3.9	1	.5	10	.8
Tenants	186	77.5	52	24.6	238	52.8
Wage workers	7	2.9	70	33.2	77	17.9
Non-cash assistants	8	3.3	88	41.7	96	21.7
Total	240	100.0	211	100.0	451	100.0

There were relatively more non-cash assistants and tenants from tenant families and more owners from owner families (Table 68). Indeed, only 1.2 percent of the sons of tenants who were farming were land owners. Land owning families who cannot give their sons land with which to start farming often do give them work stock and equipment. In this way, their boys are enabled to ascend the "agricultural ladder" more rapidly than are the sons of tenants. Partly because sons of tenant farmers were younger there was a relatively greater number of non-cash assistants from these families.

Table 68. Tenure of the Parental Families of Farming Sons in 1934 Classified by Tenure of Sons

Tenure of sons	Tenure of parental family					
	Owners		Tenants		All sons	
	Number	Per cent	Number	Per cent	Number	Per cent
Owners	27	13.4	3	1.2	30	6.8
Managers	8	3.9	2	.8	10	.8
Tenants	99	49.0	139	55.8	238	52.8
Wage workers	33	16.3	44	17.7	77	17.9
Non-cash assistants	35	17.4	61	24.5	96	21.7
Total	202	100.0	249	100.0	451	100.0

More sons of farmers in Jefferson Davis and Webster Counties owned their land than sons of the families in the other three counties (Table 69). This, as has been explained, is due to the custom in these two counties of deeding land to sons when they leave school or when they marry. The larger proportion of managers in Sunflower County is due to the fact that there are more positions of this nature available in the Delta Counties where a large part of the cotton is raised on plantations. The percentage of the farming sons who were farm laborers was much higher in Lauderdale County than in the other four counties in which the study was made. This is due to the fact that a larger proportion of sons in this county were unmarried. More farming sons in Lauderdale County had had non-farm experience and a number will doubtless return to non-farm work when it becomes more available. The boys in this county are within closer vicinity of a city than are those in the other counties. Tate County sons, like those of Lauderdale County, were rarely owners or managers. However, the sons were more likely to be tenants in Tate County, where a larger proportion of the farming sons were married, than in Lauderdale County, where they were unmarried.

Table 69. Counties in Which Parental Families of Farming Sons Resided in 1934
Classified by Tenure of Sons

Counties in which parental families reside	Form of tenure of sons					
	Owners	Managers	Tenants	Wage workers	Non-cash assistants	All sons
	Number	Number	Number	Number	Number	Number
Jefferson Davis	19	1	60	21	25	126
Lauderdale	2	—	33	15	28	78
Sunflower	1	8	45	9	21	84
Tate	1	—	44	12	11	68
Webster	7	1	56	20	11	95
Total	30	10	238	77	96	451
Percentage distribution						
Jefferson Davis	15.1	.7	47.6	16.8	19.8	100.0
Lauderdale	2.6	—	42.3	19.2	35.9	100.0
Sunflower	1.2	9.5	53.6	10.7	25.0	100.0
Tate	1.4	—	65.2	17.5	15.9	100.0
Webster	7.3	1.5	58.1	21.1	11.5	100.0
Total	6.6	2.2	52.8	17.1	21.3	100.0

Table 70. Spatial Mobility of Farming Sons Since Leaving Public School
Classified by Tenure

Tenure of sons	Always lived since leaving school					
	On same farm	In same community	In same county	In same state	Other ^a	All Sons
	Number	Number	Number	Number	Number	Number
Owners	9	10	3	5	3	30
Managers	3	—	1	4	2	10
Tenants	44	49	48	75	22	238
Wage workers	27	12	12	18	8	77
Non-cash assistants	41	15	15	21	4	96
Total	124	86	79	123	39	451
Percentage distribution						
Owners	7.3	11.7	3.8	4.1	7.7	6.8
Managers	2.4	—	1.3	3.2	5.1	.8
Tenants	35.5	56.9	60.8	60.9	56.4	52.8
Wage workers	21.8	13.9	15.2	14.6	20.5	17.9
Non-cash assistants	33.0	17.5	18.9	17.2	10.3	21.7
Total	100.0	100.0	100.0	100.0	100.0	100.0

^aIn more than one state or country.

Non-cash assistants and wage workers, or farm laborers, had more often lived continuously on the same farm than had owners, managers, and tenants, or farm operators. The former, of course, composed the younger group. Wage workers had worked in more than one state more frequently than had non-

Table 71. Occupational Histories of Farming Sons Since Leaving Public School
Classified by Tenure

Occupational histories	Form of tenure					
	Owners	Managers	Tenants	Wage workers	Non-cash assistants	All Sons
	Number	Number	Number	Number	Number	Number
Farmed only	22	2	180	63	76	543
Factory operator and laborer; farmer	—	—	11	5	5	21
College; farmer	1	3	5	3	1	13
Common laborer; farmer	—	—	6	1	5	12
Driver and carrier; farmer	1	—	6	2	1	10
Salesman; farmer	—	—	5	—	1	6
Machine and related trades; farmer	2	—	2	1	1	6
College; salesman; farmer	—	1	4	—	—	5
Common laborer; factory operator and laborer; farmer	—	—	3	—	2	5
Salesman; personal and domestic service; farmer	1	1	2	—	—	4
Common laborer; soldier, sailor; policeman, etc.; farmer	—	1	—	—	1	2
Factory operator and laborer; driver and carrier; farmer	—	—	2	—	—	2
Soldier, sailor, policeman, etc.; farmer	1	—	—	1	—	2
Other occupations and farming ^a	2	2	12	1	3	20
Total	30	10	238	77	96	451
Percentage distribution						
Farmed only	73.4	20.0	75.6	81.8	79.3	76.1
Factory operator and laborer; farmer	—	—	4.6	6.5	5.3	4.7
College; farmer	3.3	30.0	2.1	3.9	1.0	2.9
Common laborer; farmer	—	—	2.6	1.3	5.3	2.7
Driver and carrier; farmer	3.3	—	2.6	2.6	1.0	2.2
Salesman; farmer	—	—	2.1	—	1.0	1.3
Machine and related trades; farmer	6.7	—	.8	1.3	1.0	1.3
College; salesman; farmer	—	10.0	1.7	—	—	1.1
Common laborer; factory operator and laborer; farmer	—	—	1.3	—	2.0	1.1
Salesman; personal and domestic service; farmer	3.3	10.0	.8	—	—	.9
Common laborer; soldier, sailor, policeman, etc.; farmer	—	10.0	—	—	1.0	.4
Factory operator and laborer; driver and carrier; farmer	—	—	.8	—	—	.4
Soldier, sailor, policeman, etc.; farmer	3.3	—	—	1.3	—	.4
Other occupations and farming ^a	6.7	20.0	5.0	1.3	3.1	4.5
Total	100.0	100.0	100.0	100.0	100.0	100.0

^aCombinations of occupations of which there was but one case.

cash assistants. Tenants were more likely to have lived out of the community since leaving school than were owners. Eighty-six percent of all the farming sons had always lived in the same state. Sixty-four percent had always lived in the same county. The spatial mobility for this group had, therefore, not been great.⁷

In Table 71 the occupational histories of the five tenure groups are given. As may be noted, about three-fourths of each of these groups had had no occupation except farming since leaving school. Managers, however, were an exception to this statement, largely because they were made up of planters' boys and had consequently had more opportunities to secure a varied experience. The number of occupations which these boys had engaged in was probably underestimated, for the replies of the family and the farming sons disagreed in 25 per cent of the cases as to the occupational history of the son. In the majority of the cases of disagreement, the boy named an occupation (one or more) not named by the family. However, in spite of the possible inaccuracy of these data, it is believed that one can safely assume that on the whole this group of farming sons had had little except farm experience.⁸

Farm Homemakers

As has been shown there were 327 daughters with no regular non-agricultural work married to men engaged in farming at the time of the study. One hundred and nine of these, however, earned money from the sale of farm products or an occasional non-farm job.⁹ The relatively small percentage of farm homemakers who supplemented the family income by the sale of farm products may be explained in a number of ways. In the first place, these were young women, many just starting their homemaking careers. The ma-

Table 72. Method of Earning of the 109 Gainfully Engaged Farm Homemakers Classified by Tenure of Their Husbands

Method of earning ^a	Tenure of husbands of daughters					
	Owners	Managers	Tenants	Wage workers	Non-cash assistants	All husbands
	Number	Number	Number	Number	Number	Number
Sale of farm products.....	36	4	75	1	1	117
Poultry and products ...	28	1	60	1	1	91
Milk and products.....	6	2	9	—	—	17
Vegetables.....	2	1	5	—	—	8
Livestock.....	—	—	1	—	—	1
Farm labor ^b	—	—	2	—	—	2
Supplementary non-farm work.....	3	—	6	—	—	9
Record taking.....	1	—	—	—	—	1
Sewing.....	2	—	4	—	—	6
Laundry work.....	—	—	2	—	—	2
Total.....	39	4	83	1	1	128

^aSome of the women had several methods of earning.

^bSecondary or supplementary. If it had been a main occupation, the daughters would not have come in this group.

⁷The disagreement in the replies of the family and the farming sons concerning their spatial mobility was 18 per cent. It is thought, however, that this was a question which was misunderstood by a number, since in some of the replies the answers contradicted the information given in their occupational histories. Some checked all items. See discussion in the Appendix A, p. 114.

⁸See Appendix A, p. 111.

⁹There was a 22 percent disagreement in the replies of the family and farming daughter as to whether she supplemented her husband's income. However, the parents frequently reported that she did when she reported she did not. This, it is thought, is due to the fact that various ways of supplementing incomes were listed on the schedule but not on the questionnaire. Without a doubt had such a list been included in the questionnaire the results of the check would have been quite different. See Appendix A, p. 114, for full discussion.

jority had small children and did not have any paid help. Their mothers often frankly said, "No, my daughter doesn't have time for raising farm products for sale." In the second place, many of these young women lived in remote rural communities where it was difficult to sell cash food crops. Persons who might have served as buyers raised these products themselves. Then, too, prices offered for food crops were so low that many felt it did not pay to sell them. One woman reported having sold a hen for 25 cents. This, of course, was an exceptionally low price even in a rural community. Many families said that they, as well as their daughters, would produce more food products for sale if they could be assured of a regular market.

It would seem from interviews with hundreds of these families that perhaps the agricultural forces of the State in their effort to bring about maximum production at least cost have undervalued the importance of the distributive process. The Mississippi Experiment Station now employs one or more men to study the productive process of every type of farm product, but little emphasis is placed on research in the distributive process. Young farm homemakers will produce foods for market if given a regular market for their products. In Tate County a large percentage of the farm homemakers supplemented the income of their husbands, for traders from Memphis came through the country-side regularly paying cash for eggs, chickens, vegetables, and the like. Indeed, the need for local markets is one of the greatest needs in Mississippi today!

Not only were questions concerning the married daughter's gainful employment asked of the family, but also questions concerning her non-gainful work; that is, whether or not she worked in the field, did farm work, i. e., dairy, garden or poultry work and house work. All daughters did some house work; the majority did all their house work (Table 73). All except seven of them did some garden, dairy or poultry work. Sixty-five per cent worked in the field; that is, helped to pick and chop cotton. Farm women and girls of Mississippi rarely plow the land. This work is considered too heavy for women.

Table 73. Type of Non-gainful Work Done by Farm Homemakers Classified by Tenure of Husbands

Tenure of husband	Non-gainful work done					
	Field work		Dairy, garden, poultry		House work	
	Number	Per cent ^a	Number	Per cent ^a	Number	Per cent ^a
Owners	37	50.0	72	97.3	74	100.0
Managers	—	—	3	100.0	3	100.0
Tenants	173	72.1	236	98.3	240	100.0
Wage workers	1	25.0	3	75.0	4	100.0
Non-cash assistants	3	50.0	6	100.0	6	100.0
Total	214	65.4	320	97.9	327	100.0

^aPer cent of the total number in that group.

Managers, wage workers, and non-cash assistants do not make a crop of their own and there would, therefore, be less pressure for the wife to go to the field to help her husband. However, the number of daughters with husbands in these three groups was too limited for the findings to be significant. The number of daughters with husbands who were owners and tenants, however, was sufficiently great, it would seem, to state definitely, in spite of the high percentage of disagreement in the replies of the family and farming daughters,¹⁰ that the wives of owners went to the field less frequently than did the wives of tenants (Table 73). Wives of owners more frequently raised food

¹⁰The disagreement in the replies of daughters and family concerning working in the field was 20 per cent. For discussion see Appendix A, p. 115.

products for sale and would, therefore, have less time for field work. Then, too, in the higher social strata field work is not usually done by women. Owners' wives undoubtedly have more social prestige than do wives of tenants.¹¹

There were three times as many farming sons-in-law who were land owners as there were farming sons who were land owners. This is largely due to the fact that sons-in-law were older than sons. They had had longer occupational careers and consequently more time to save for buying a farm. Then, too, since they were older, more of them had inherited land than had sons. There was a tendency for the older daughters likewise to be more often wives of land owners than the younger daughters (Table 74). Forty per cent of the married daughters 29-33 years of age were wives of owners, whereas only 17 per cent from 19-23 years of age were wives of owners.

The greater her education¹² the greater the likelihood of the daughter's being married to a land owner (Table 75). This may be due to two factors. In the first place, the more educated daughters come from the more prosperous

Table 74. Ages of Farm Homemakers Classified by Tenure of Husbands^a

Tenure of husbands	Farm homemakers of specified ages						All farm homemakers	
	19-23 years		24-28 years		29-33 years		Number	Per cent
	Number	Per cent	Number	Per cent	Number	Per cent		
Owners	21	17.2	22	17.3	31	39.7	74	22.0
Managers	—	—	1	.8	2	2.6	3	.9
Tenants	98	80.3	99	78.0	43	55.1	240	74.1
Wage workers	1	.8	3	2.4	—	—	4	1.2
Non-cash assistants	2	1.7	2	1.5	2	2.6	6	1.8
Total	122	100.0	127	100.0	78	100.0	327	100.0

^aThere was an 8 per cent disagreement in the replies of family and of farming daughters as to age group.

Table 75. Education of Farm Homemakers Classified by the Tenure of Their Husbands^a

Tenure of husbands	Education of daughters				All farm homemakers
	8th grade and under	High school training	High school graduate	College training	
	Number	Number	Number	Number	Number
Owners	26	32	14	2	74
Managers	1	2	—	—	3
Tenants	123	92	23	2	240
Wage workers	3	1	—	—	4
Non-cash assistants	3	3	—	—	6
Total	156	130	37	4	327

Percentage distribution

Owners	16.7	24.6	37.8	—	22.0
Managers	.7	1.6	—	—	.9
Tenants	78.8	70.8	62.2	—	84.1
Wage workers	1.9	.7	—	—	1.2
Non-cash assistants	1.9	2.3	—	—	1.8
Total	100.0	100.0	100.0	—	100.0

^aThere was an 8 per cent disagreement in the replies of family and of farming daughters as to education group.

¹¹Generally speaking, this is true, but in some cases the husbands were renting land they would inherit. In other words, although they were classified as tenants, they were in reality owners without title. Such couples would have as much social prestige as land owners; in fact, more than some land owners since they were often related to prominent farm families in the community.

¹²There was only a slight tendency for the more educated sons to be in the "higher" tenure groups. This was without doubt due to the fact that many sons were still in their early youth. A comparison twenty years hence would probably be more significant.

homes and would, consequently, more frequently, marry men in a similar class. (Both parties often inherit land.) In the second place the more educated girls may assist their husbands in becoming landowners more than the less educated.¹³ Not only were the older and better educated girls more likely to be married to landowners but also daughters of landowners were more likely to be married to landowners. As has been previously suggested, the daughter of a family is very dependent on the economic position of her parental family for occupational status. As a rule, she can make a better marriage if her family are prominent landowners. Landowning fathers often give their sons-in-law, as well as their sons, a start in farming. Land, as well as working equipment, is frequently made available to them.

Table 76. Tenure of Parental Families of Farm Homemakers in 1934 Classified by Tenure of Their Husbands

Tenure of husbands	Tenure of parental family					
	Owners		Tenants		All farm homemakers	
	Number	Per cent	Number	Per cent	Number	Per cent
Owners	48	34.0	26	14.0	74	22.0
Managers	3	2.1	—	—	3	.9
Tenants	95	60.3	155	83.3	240	74.1
Wage workers	3	2.1	1	.5	4	1.2
Non-cash assistants	2	1.5	4	2.2	6	1.8
Total	141	100.0	186	100.0	327	100.0

Table 77. Occupations of Farm Homemakers Before Marriage Classified by Tenure of Their Husbands

Occupations of daughters before marriage	Tenure of husbands					
	Owners	Managers	Tenants	Wage workers	Non-cash assistants	All husbands
	Number	Number	Number	Number	Number	Number
Farm-home assistant	38	1	144	2	5	190
Left school to marry ^a	26	—	79	2	1	108
Saleswoman	3	1	4	—	—	8
Vocational course	3	—	3	—	—	6
Professional service	—	1	3	—	—	4
Factory operator and laborer....	—	—	3	—	—	3
Personal and domestic service....	1	—	2	—	—	3
Machine and related trades.....	1	—	1	—	—	2
College	1	—	1	—	—	2
Clerical service	1	—	—	—	—	1
Total	74	3	240	4	6	327

^aIt was sometimes difficult to decide whether to place the daughter in the farm-home assistant group or the group who left school to marry, but if she left during the school session or the summer session she was classified as leaving school to marry.

A little over half (60 percent) of the farm homemakers were farm-home assistants before they married; one third left school to marry (Table 77). Six girls were taking or had just completed a vocational course at the time of marriage. Several of the parents of those who had left vocational courses to marry or who had married as soon as the courses were completed spoke of the money spent on this training as being wasted. However, the daughters themselves did not feel this way about their training. One said, "My six months in business college taught me as much as I learned two years in high school." Two left college to marry. Only 23 were gainfully employed at the time of marriage.

¹³Walter W. Wilcox and O. G. Lloyd state in their study, *The Human Factor in the Management of Indiana Farms* that one of the personal and environmental factors most closely related to variations in labor income is "help and stimulation the men received from their wives". Purdue University Agricultural Experiment Station, Bulletin 369 (La Fayette, 1932), p. 2.

About 90 percent of the farm homemakers had had no gainful occupation since they left school (Table 78). There was little difference in the occupational histories of daughters married to owners and to tenants. Wives of owners had a somewhat more varied occupational experience, but not significantly so. The farm was about all this group knew. Any program for the purpose of providing means whereby these women can supplement the family income should take cognizance of this fact. The paucity of the gainful occupations of this group is not due to inadequate data obtained from the parental family. Indeed, the disagreement in the replies of the family and daughter concerning the occupational history of the daughter was very low, only 4 percent.

Table 78. Occupational Histories of Farm Homemakers Since Leaving Public School Classified by Tenure of Their Husbands

Occupational histories	Tenure of husbands					
	Owners	Managers	Tenants	Wage workers	Non-cash assistants	All husbands
	Number	Number	Number	Number	Number	Number
Farm-home assistant; housewife	37	1	139	2	5	184
Housewife only	26	—	75	2	1	104
Saleswoman; housewife	1	1	5	—	—	7
Special course; housewife	2	—	4	—	—	6
Professional service; housewife	—	1	2	—	—	3
Saleswoman; farm-home assistant; housewife	1	—	2	—	—	3
Factory operator and laborer; housewife	—	—	3	—	—	3
Farm-home assistant; personal and domestic service; housewife	—	—	2	—	—	2
College; housewife	1	—	1	—	—	2
Other occupations and housewife ^a	6	—	7	—	—	13
Total	74	3	240	4	6	327
Percentage distribution						
Farm-home assistant; housewife	50.0	—	57.9	—	—	56.3
Housewife only	35.0	—	31.3	—	—	31.8
Saleswoman; housewife	1.4	—	2.1	—	—	2.2
Special course; housewife	2.7	—	1.7	—	—	1.8
Professional service; housewife	—	—	.8	—	—	.9
Saleswoman; farm-home assistant; housewife	1.4	—	.8	—	—	.9
Factory operator and laborer; housewife	—	—	1.3	—	—	.9
Farm-home assistant; personal and domestic service; housewife	—	—	.8	—	—	.6
College; housewife	1.4	—	.4	—	—	.6
Other occupations and housewife ^a	8.1	—	2.9	—	—	4.0
Total	100.0	—	100.0	—	—	100.0

^aCombinations of occupations of which there was but one case.

Farm-home Assistants

There were in this study 116 farm-home assistants, or unmarried daughters, living at home. These young women had no definite business arrangement with their families. If they had, they would have been classified as wage workers as were their brothers under similar circumstances. It is not customary for farmers to give a portion of the crop or pay a regular wage to their daughters as they sometimes do their sons.

As is shown in Table 79, few of the farm-home assistants had any gainful work. Only nine produced farm products for sale. Two did wage work occasionally and four did some sewing. It is as difficult in predominantly rural areas to secure sewing as it is to sell farm products, since those who would be available as customers have machines and do their own sewing. The proportion of farm home-makers gainfully engaged was three times greater than the proportion of farm-home assistants gainfully engaged.¹⁴ The incentive for earning was probably greater in the case of farm homemakers. Then, too, in many cases the mothers of the farm-home assistants had these methods of earning.

As may be noted, about 88 percent of the group (or the majority) worked in the field; 95 percent did garden, poultry and dairy work. Only 3 daughters were taking their mothers' place; the others assisted their mothers in the home. The amount of assistance they rendered varied considerably, but the vast majority entered quite actively into farm and household tasks. This is as it should be, because if they are to live on the family farm and derive their food and clothing from it, they in turn should give their services. The majority of the girls realized their responsibility. A number chafed under it, "but what else is there to do?", they asked. The church was the only organization with which many of them were affiliated. Many were without outside interests and hobbies. Some were openly dissatisfied. "Oh, if there were just something to do! All my friends are married." Of course, there were some differences existing in the extent to which communities were meeting the needs of these young women. However, no community in this study had adequately met the serious lack of vocational and cultural education of this group.

Table 79. Method of Earning of the 15 Gainfully Engaged Farm-home Assistants

Method of earning	Number	
Sale of farm products	9	
Poultry and poultry products		2
Dairy products		6
Livestock		1
Farm labor	2	
Supplementary non-farm work	4	
Sewing		4
Total	15	

Table 80. Occupational Status in Their Families of 116 Farm-home Assistants

Occupational status in family	Number	Per cent
Does farm work		
Works in field	102	87.9
Does garden, dairy, and poultry work	110	94.8
Does household work		
Takes mother's place	3	2.6
Assists in home	113	97.4

Table 81. Ages of Farm-home Assistants

Age groups	Number	Per cent
19-23 years	80	68.9
24-28 years	25	21.6
29-33 years	11	9.5
Total	116	100.0

¹⁴As will be remembered, questionnaires were not sent to children living at home. Therefore, there are no checks on the accuracy of these data. However, in the majority of cases the farm-home assistant was present at the interview. The data presented in this section are, therefore, for the most part the combined judgment of the parental family and the child.

About 69 percent of the farm-home assistants were in the 19-23-year age group, while only 37 percent of the farm homemakers were in this group. Only 10 percent of the farm-home assistants were in the 29-33-year group, while 24 percent of the farm homemakers were in this age group. Farm-home assistants were, therefore, as a rule the younger daughters, many of whom will eventually marry farmers.

As may be noted from Table 82, nearly one-half of farm-home assistants were high-school graduates; nearly one-tenth had been to college. This was much more education than the farm homemakers had had. Only 11 percent of them had graduated from high school; 1 percent had been to college. The farm-home assistant who does not desire to continue as a farm assistant or to accept the alternative marriage with a farmer is in need of a wider range of high school and vocational courses with more part-time night classes, as well as some sort of apprentice system.

Of those who were farm-home assistants, two-thirds were owners' children; one-third tenants' children (Table 83). Daughters of tenants married earlier. A number of the daughters of owners who were farm-home assistants will undoubtedly secure non-farm work should economic conditions improve.

Table 82. Education of Farm-home Assistants

Education	Number	Per cent
8th grade and under	25	24.2
High-school training	34	29.3
High-school graduate	45	38.7
College training	9	7.8
Total	116	100.0

Table 83. Tenure of Parental Families of Farm-home Assistants in 1934

Tenure of parental family	Number	Per cent
Owner	77	66.4
Tenant	39	33.6
Total	116	100.0

Table 84. Occupational Histories of Farm-home Assistants Since Leaving School

Occupational history	Number	Per cent
Farm-home assistant only	97	83.6
College; farm-home assistant	9	7.8
Vocational course; farm-home assistant	3	2.6
Saleswoman; farm-home assistant	3	2.6
Other occupations and farm-home assistant ^a	4	3.4
Total	116	100.0

^aCombinations of occupations of which there was but one case.

The vast majority (94 percent) of the farm-home assistants had never had a gainful occupation. Eighty-four percent had been farm-home assistants since leaving school. Three of the daughters had taken business courses, but had been unable to secure work. The daughters who had been to college were in a similar position.

CHAPTER VIII.

NON-FARMING SONS AND DAUGHTERS

In this chapter it is proposed to analyze in some detail the occupations and the occupational histories of the second occupational group or those in non-agricultural pursuits. In Chapters IV, V and VI the characteristics and family background of the non-farming group were presented. This chapter

will center upon the nature of their occupations. Were they predominantly skilled, unskilled, or professional? What influenced their choice of occupations? The occupational histories of this group will also be analyzed. Although their occupation at the time of the study was non-agricultural, have they had no farming experience? What else do their occupational histories show?

The classification of the occupations to be used in the analysis of occupations of the non-farm group is similar to the classification given by Alba M. Edwards in "Social Economic Grouping of the Gainful Workers of the United States."¹ However, it differs in certain respects. Unskilled and semi-skilled workers were grouped together in this study, while Edwards grouped them separately. From the description of the occupations given by the parental family it was often difficult to tell whether the son and daughter were doing unskilled or semi-skilled work. For this reason it was thought more desirable to place the two groups together. Edwards placed managers and officials in the group with proprietors. In this study proprietors were listed separately; managers placed with clerks and kindred workers. In a number of cases it was difficult to draw a line between skilled and semi-skilled wage earners. However, workers in occupations requiring a long period of training or apprenticeship were classified as skilled. Those in occupations which could be learned in a comparatively short time were classified as semi-skilled.

Non-farming Sons

There were 160 sons engaged in non-farm work at the time of the study—only 11 of these were independent business men. This was about the same proportion as in the farming group who owned their own farms. Opportunities for young men to own their businesses, like opportunities to own their farms, have become fewer and fewer. The traditional American point of view of a young man in his own business is not typical, at least for this group. Going into business for oneself is, for the most part, for those who have capital.

Although the proportion of non-farm sons who were independent business men was about the same as the proportion of farming sons who were land owners, the proportion in the two groups doing managerial work was not. Ten percent of the non-farm sons were proprietors or managers, while 60 percent of the farm sons were farm operators.² In other words, more farming sons had the opportunity of exercising the managerial function than non-farming sons. Farming is an occupation of greater independence than are most other kinds of work.

The fact that 45 percent of the non-farm sons were unskilled and semi-skilled laborers was due, in a large measure, to the lack of opportunity. Sons who were unskilled and semi-skilled laborers outnumbered those who were skilled laborers by more than two to one (Table 85). Skilled work, of course,

Table 85. Occupations of Sons in Non-Farming Pursuits

Occupations	Number	Per cent
Unskilled and semi-skilled laborers	72	45.0
Skilled laborers	30	18.7
Managers, clerks and kindred workers.....	39	24.4
Professional men	8	5.0
Independent business men.....	11	6.9
Total	160	100.0

¹Alba M. Edwards, "A Social-Economic Grouping of the Gainful Workers of the United States". *Journal American Statistical Association*, December 1933, pp. 377-87.

²Nearly 18 percent of the group operating farms were, however, sharecroppers. Although sharecroppers are classified as farm operators in this study, in reality the majority of them do not have much more opportunity for exercising the managerial function than do wage earners.

requires special training, either through a course of study or through an apprenticeship. One must spend time learning to do skilled work. Many cannot or will not do this. Many must take the most expedient job—the job that pays the best at the time. Of course, some unskilled and semi-skilled work leads to skilled work, but many kinds of unskilled work serves in no wise as an apprenticeship to skilled trades. Unskilled and semi-skilled work takes less training and experience than does the work required in the other four kinds of non-farm occupations, and, therefore, greater numbers enter it. In fact, it is about the only kind of work except farming which an untrained, inexperienced person can pursue. There was, indeed, no such thing as effective freedom in the choice of an occupation for most of the children in this study.

About 25 percent of the non-farming sons were managers, clerks and kindred workers (Table 85). This group embraces for the most part the group known as "white collar workers." Managers are not usually classified as "white collar workers," but they were in this study as the number of managers was small and the managership was of small establishments only. In 1930 almost one male worker in every six in the United States was a white collar worker.³ In this study, only one in every 18 was a manager, clerk, or kindred worker. However, there were many evidences of a desire on the part of parents and children to enter this kind of occupation. It was thought more desirable than being a farm tenant or an unskilled laborer—occupations followed by the majority. If increasing numbers enter this kind of work, the income derived from it will become correspondingly lower; but after all, should not the wages or salaries from the more desirable occupations be lower? Should the privileged few have the occupations which are desirable both from the standpoint of working conditions and wages and salaries paid?

Professional work requires more training than is required in the four other kinds of occupations. Indeed, it usually means college training. It is, therefore, not surprising that only 5 percent of the non-farm sons were professional men.

Only 4 of the 160 sons had a supplementary or secondary occupation.⁴ Two of these were independent business men and the other two were in seasonal occupations. However, there was a disagreement of 10 percent in the replies of the family and non-farming sons concerning his supplementary or secondary occupation, the son more often stating that he had supplementary or secondary work than did the family. In any case, the number of non-farm sons with more than one occupation was not great.

Twenty-two of the non-farm sons were living in the homes of their parents.⁵ This differed markedly from the number of farm sons at home. However, there was little non-farm work available near the parental home. The majority of those living at home following non-agricultural pursuits, did unskilled and semi-skilled work. Only 5 of the non-farming sons at home were sons of tenants; the remaining were sons of owners.

As may be noted in Table 86, the younger sons were unskilled and semi-skilled wage workers more often than the older sons. The group 19-23 years of age contained relatively two times more unskilled and semi-skilled laborers than the group aged 24-28, and four times more unskilled and semi-skilled laborers than those 29-33 years. The fact that 18 sons enrolled in C. C. C. Camps were classified as unskilled and semi-skilled laborers exaggerated the tendency, for 14 of the sons in C. C. C. Camps were 19-23 years of age. The

³Alba M. Edwards, "The White-Collar Workers", *Monthly Labor Review*, (March 1934) p. 3.

⁴Non-farming sons who were also regularly engaged in farming were, of course, classified as part-time farmers.

⁵This does not include 6 sons who were unemployed.

other four were 24-28 years of age. However, even when the C. C. C. Camp group are excluded, the proportion of sons 19-23 years of age engaged in unskilled and semi-skilled work was 62 percent, or the majority of the group.

In the older groups the situation of course was the reverse. There were nine times more skilled laborers 29-33 years of age than 19-23 years of age; two times more managers, clerks, and kindred workers; three times more professional workers; and four times more independent business men. Indeed, it would seem that unskilled and semi-skilled labor is the "stepping stone" to other types of non-farm work, as farm labor is to farm operation; and it is in many cases. Sometimes, as has been suggested, it is the training school for skilled work. Sometimes it serves to put one in touch with other types of non-farm occupations. That is, through unskilled and semi-skilled work one is enabled to make contacts which lead later to securing non-agricultural work of other kinds. Furthermore, it often enables one to save enough money to take the necessary training for other work. However, that the road to the other four kinds of occupations is not always through unskilled and semi-skilled work is evidenced by the fact that eleven of the managers, clerks, and kindred workers, three of the professional workers, and eight of the skilled laborers had had no other kind of occupation.

Most of the sons with 8th grade schooling and less were unskilled and semi-skilled workers; most of those with high-school training were managers,

Table 86. Ages of Non-farming Sons Classified by Their Occupation^a

Occupations	Sons of specified ages							
	19-23 years		24-28 years		29-33 years		All sons	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Unskilled and semi-skilled laborers	27	77.2	33	47.2	12	21.8	72	45.0
Skilled laborers	1	2.8	15	21.4	14	25.5	30	18.7
Managers, clerks and kindred workers	5	14.5	16	22.8	18	32.7	39	24.4
Professional men	1	2.8	2	2.9	5	9.1	8	5.0
Independent business men	1	2.8	4	5.7	6	10.9	11	6.9
Total	35	100.0	70	100.0	55	100.0	160	100.0

^aThere was a disagreement of only 3 percent in the replies of family and non-farming sons as to the age group.

Table 87. Education of Non-farming Sons Classified by Their Occupation^a

Occupations	Education of sons				
	8th grade and under	High-school training	High-school graduate	College training	All sons
	Number	Number	Number	Number	Number
Unskilled and semi-skilled laborers	31	20	15	6	72
Skilled laborers	10	14	6	—	30
Managers, clerks and kindred workers	2	22	9	6	39
Professional men	—	—	—	8	8
Independent business men	4	2	2	3	11
Total	47	58	32	23	160

Percentage distribution

Unskilled and semi-skilled laborers	65.0	34.5	46.8	26.1	45.0
Skilled laborers	21.2	24.1	18.8	—	18.7
Managers, clerks and kindred workers	4.3	37.9	28.1	26.1	24.4
Professional men	—	—	—	34.8	5.0
Independent business men	8.5	3.5	6.3	13.0	6.9
Total	100.0	100.0	100.0	100.0	100.0

^aThere was a 3 percent disagreement in the replies of the family and non-farming sons as to education group.

clerks, and kindred workers. More high-school graduates were unskilled and semi-skilled laborers. However, if the C. C. C. group, classed as unskilled laborers, is withdrawn the greater proportion of the high-school graduates were managers, clerks, and kindred workers. All of the professional men in this study had had college training. With the increased requirement in the professions, one finds fewer and fewer professional workers who have not been to college. The other occupational group containing a relatively high proportion of college-trained sons was the independent business men. However, of these sons who were independent business men, there were more in actual numbers with 8th grade training than with college training.

Sons of owners were more often managers, clerks, and kindred workers, whereas sons of tenants were more frequently unskilled and semi-skilled workers (Table 88). This would be expected since tenants' sons were younger and did not have as much education as owners' sons. Nine sons of owners and nine sons of tenants were in C. C. C. Camps, which means that there were relatively somewhat more tenants' sons in C. C. C. Camps, but the difference was not great.

In all of the five counties in which the study was made, the majority of the non-farming sons were in unskilled and semi-skilled work. The proportion in this kind of work was greatest, however, in Jefferson Davis and Webster Counties, the predominantly rural counties (Table 89). Sons of families of Lauderdale County led in the proportion in skilled work. Some of these boys worked in Meridian; others outside the state. Tate County led in the proportion employed as managers, clerks, and kindred workers. A number of

Table 88. Tenure of the Parental Families of Non-farming Sons in 1934 Classified by Occupation of Son

Occupations	Tenure of Parental family					
	Owners		Tenants		All sons	
	Number	Per cent	Number	Per cent	Number	Per cent
Unskilled and semi-skilled laborers.....	32	32.7	40	64.5	72	45.0
Skilled laborers	18	18.4	12	19.4	30	18.7
Managers, clerks & kindred workers	34	34.7	5	8.1	39	24.4
Professional men	7	7.1	1	1.6	8	5.0
Independent business men	7	7.1	4	6.4	11	6.9
Total	98	100.0	62	100.0	160	100.0

Table 89. Occupations of Non-farming Sons Classified by County of Residence of Parental Family

Occupations	Counties in which parental families reside					
	Jefferson Davis	Lauderdale	Sunflower	Tate	Webster	All sons
	Number	Number	Number	Number	Number	Number
Unskilled and semi-skilled laborers.....	9	17	14	19	13	72
Skilled laborers	1	16	8	4	1	30
Managers, clerks & kindred workers.....	1	13	9	11	5	39
Professional men	—	4	3	1	—	8
Independent business men	2	2	4	3	—	11
Total	13	52	38	38	19	160

Percentage distribution

Unskilled and semi-skilled laborers.....	69.2	32.9	36.8	50.1	68.4	45.0
Skilled laborers	7.7	30.8	21.2	10.6	5.3	18.7
Managers, clerks & kindred workers.....	7.7	25.0	23.9	28.9	26.3	24.4
Professional men	—	7.8	7.9	2.6	—	5.0
Independent business men	15.4	3.5	10.2	7.8	—	6.9
Total	100.0	100.0	100.0	100.0	100.0	100.0

these Tate County sons were in Memphis. None of the professional men came from Jefferson Davis and Webster Counties. However, the number of sons in non-farm pursuits from these two counties was very limited. Non-farming sons in Webster County, who were not unskilled and semi-skilled laborers, were usually managers, clerks, and kindred workers; in Jefferson Davis County, they were usually proprietors. It will be recalled that Jefferson Davis County was also the county having the highest proportion of owner sons.

It is interesting to note that the spatial mobility of non-farm sons had been much greater than that of farm sons. Eighty-six percent of the farming sons had always lived in the same state, while only 58 percent of the sons, engaged in other kinds of occupations, had always lived in the same state. There were about twice as many sons in agricultural pursuits who had lived in the same county since leaving school as there were sons in non-agricultural pursuits having lived in the same county. Unskilled and semi-skilled laborers had more frequently worked in more than one state; skilled laborers in the same town; managers, clerks, and kindred workers and independent business men in the same county; and professional men in the same position (Table 90). In other words, the spatial mobility of the sons in the occupation having the lowest socio-economic status (unskilled and semi-skilled work) was greatest.⁶

Table 90. Spatial Mobility of Non-farming Sons Since Leaving Public School
Classified by Their Occupations

Occupations	Always worked:					All Sons
	In same position	In same town	In same county	In same state	Other ^a	
	Number	Number	Number	Number	Number	Number
Unskilled and semi-skilled laborers.....	6	9	7	13	37	72
Skilled laborers	2	6	3	6	13	30
Managers, clerks & kindred workers	4	5	9	10	11	39
Professional men	2	—	—	2	4	8
Independent business men.....	1	1	3	4	2	11
Total	15	21	22	35	67	160
Percentage distribution						
Unskilled and semi-skilled laborers.....	40.0	42.9	31.8	37.1	55.2	45.0
Skilled laborers	13.3	28.6	13.6	17.1	19.4	18.7
Managers, clerks & kindred workers	26.6	23.8	41.0	28.6	16.4	24.4
Professional men	13.3	—	—	5.7	6.0	5.0
Independent business men.....	6.8	4.7	13.6	11.5	3.0	6.9
Total	100.0	100.0	100.0	100.0	100.0	100.0

^aIn more than one state or country.

In Table 91, the number of occupations engaged in by the non-farm sons since leaving school is given. The number of occupations rather than the occupational histories is given, as the 160 sons had had a total of 88 different occupational histories. As will be remembered, the 451 farming sons had had only 33 different occupational histories. Fourteen percent of the non-farming sons had had only one occupation, whereas 76 percent of the farming sons had had only one occupation. Forty-nine percent of the sons in non-agricultural pursuits had two occupations, while only 17 percent of the sons engaged in agricultural pursuits had had this number. Only 5 percent of the sons who were farming had had three occupations; and 2 percent had had four occupations; while of those engaged in occupations other than farming, 26 percent had had three occupations; and 11 percent had had four occupations. In other

⁶The disagreement in the replies of the family and non-farming sons concerning spatial mobility was 16 percent.

Table 91. Number of Occupations Held by Non-farming Sons Since Leaving School
Classified by Their Occupation

Number of occupations ^a	Kind of Occupation					
	Unskilled and semi-skilled laborers	Skilled laborers	Managers, clerks and kindred workers	Professional men	Independent business men	All sons
	Number	Number	Number	Number	Number	Number
1 occupation only.....	10	3	9	—	—	22
2 occupations	36	20	15	3	4	78
3 occupations	20	7	8	3	3	41
4 occupations	5	—	6	2	4	17
5 occupations	1	—	—	—	—	1
6 occupations	—	—	1	—	—	1
Total	72	30	39	8	11	160
Percentage distribution						
1 occupation only.....	13.9	10.0	23.1	—	—	13.8
2 occupations	50.0	66.7	38.5	37.5	36.4	48.8
3 occupations	27.8	23.3	20.5	37.5	27.2	25.6
4 occupations	6.9	—	15.4	25.0	36.4	10.6
5 occupations	1.4	—	—	—	—	.6
6 occupations	—	—	2.5	—	—	.6
Total	100.0	100.0	100.0	100.0	100.0	100.0

^aAccording to the "character of work". College and vocational courses were counted as an occupation.

words, sons not farming at the time of the study, had had much more varied occupational careers.

Eighty-five of the 160 sons now engaged in work off the farm had farmed at some time since leaving school. Indeed, many of their occupational histories ran thus: farmer, machine and related trades; farmer, common laborer; farmer, driver and carrier, and factory operative and laborer. A great many of these sons had farmed for a while before they entered non-farm work. Some had secured work off the farm immediately after they left school, then returned to the farm for a while only to leave it for non-farm work again. The first few years out of school served for a few as an experimental period of trying out different occupations. Since the depression, this testing of occupations has not been possible to any great extent.

The number of occupations engaged in by the 160 sons in non-agricultural pursuits, as listed in Table 91, is undoubtedly an underestimation of actual fact, for the replies of non-farming sons and parental families showed a high disagreement (37 percent). In the majority of cases the son named one or more occupations not named by his family. In spite of these inadequate data, it is thought that one can assume that non-farming sons had had on the whole more varied occupational careers than farming sons and that a great number of them had had farming as well as non-farming experience.⁷

It is interesting to know not only about the occupational histories of the non-farming group as a whole, but also about the occupational histories of those in the five kinds of non-farming occupations. As may be noted (Table 91) unskilled and semi-skilled workers and managers, clerks, and kindred workers, had had more occupations than had skilled workers. Especially was this so for the older sons doing unskilled and semi-skilled work and serving as managers, clerks, and kindred workers. Of the sons 29-33 years of age, 45 percent of the unskilled and semi-skilled laborers and 51 percent of the man-

⁷The disagreement in the replies of the family and non-farming sons when the social-economic occupational classification was used was less (24 percent). See Table 129, p. 131, for the occupational histories of the non-farming sons thus classified.

agers had had more than two occupations. Only 25 percent of the skilled laborers in this age group had had more than two occupations. Independent business men had had relatively more occupations than the other occupational groups. Professional men appear to have had varied occupational careers, but, due to the fact that all professional men had had college training and to the fact that attending college was limited as an occupation, the number of occupations followed by this group was in reality similar to the number of occupations followed by skilled laborers. In other words, skilled laborers and professional men showed the least change in the number of occupations followed since leaving school.

Daughters with Non-farm Occupations

There were 62 daughters who had non-farm work at the time of the study. The occupational distribution of these daughters differed quite a bit from sons with non-farm occupations. Sons were more frequently unskilled and semi-skilled laborers; daughters more frequently professional workers. Mississippi is not an industrial state and, therefore, offers few opportunities to women in the unskilled and semi-skilled trades. However, within the last few years the number of industries in the state has increased. This process will be enhanced undoubtedly in the future, for there is an economic advantage in establishing mills close to the source of raw materials and then, too, labor may be obtained at a lower wage than in the North, due to the mild climate and lower living cost.

Table 92. Occupations of Daughters Engaged in Non-farm Work

Occupations	Number
Unskilled and semi-skilled laborers	16
Skilled laborers	4
Managers, clerks and kindred workers	15
Professional women	26
Independent business women	1
Total	62

The effect of the location of a factory in a rural county upon the farm girls of the county is well illustrated by the garment factory in Marion County, a county adjoining Jefferson Davis County and composed for the most part of farm families, similar to those in Jefferson Davis County. Practically all the girls employed in the garment factory live on adjacent farms and were born and reared in Marion County. They live on the farms where they were reared, riding to work in busses or the family "flivver". Girls in this county are enabled to better their lot in life because of the money they earn working in the garment factory—a work far easier and less irksome, and more remunerative than hoeing cotton in the fields. One of the girls who worked in this factory said, "I have had more pretty dresses since this factory came to town than I ever had before in my life." She earns real money now, whereas, while working on the farm she only earned her food and a few clothes now and then.

The proportion of daughters having the occupation of managers, clerks, and kindred workers, was about the same as the proportion of sons having this occupation. There was about the same proportion of daughters as sons who were salesmen and clerical workers. The percentage of daughters engaged in professional work was about eight times that of sons. This is due to the relatively large number of rural girls entering the teaching profession. Only one daughter owned a business whereas eleven sons did so. Women have been in the business world for a comparatively short time as compared with men, and, therefore, it is not surprising that so few had businesses of their own. Then, too, women are paid less for similar work and consequently since capital

is needed to start a business, naturally fewer could save a sufficient amount to finance a business of their own.

Twenty-two of those regularly engaged in non-farm pursuits had as a secondary occupation, housekeeping.^a These were all married women who were doing their own housework in addition to holding a full-time non-farm job.^a Of the 25 married women with a non-farm occupation, only three did not do their own housekeeping. It is, of course, not customary for a gainfully employed wife to take an easy seat by the fire when she returns from work and to wait for her husband or children to serve the meal.

Although the occupation of the husband was disregarded in classifying the group of married women with a non-farm occupation, it seems important to give this information, as the occupations of the wife and husband are generally related. What the husband does has a bearing on what his wife does. A farmer's wife has, as a rule, little possibility of securing a full-time non-farm job if she lives with her husband on the farm. On the other hand, if her husband is located in the city, she will not find as much difficulty in securing such work.

Table 93. Occupations of Husbands of Daughters with non-farm Occupations

Occupations of husbands ^a	Occupations of daughters					
	Unskilled and semi-skilled laborers	Skilled laborers	Managers, clerks, and kindred workers	Independent business women	Professional women	All married daughters
	Number	Number	Number	Number	Number	Number
Salesman	—	1	2	—	3	6
Proprietor	1	—	1	—	3	5
Driver and carrier....	3	—	1	—	—	4
Farmer	1	—	—	—	1	2
Clerical worker	—	—	1	1	—	2
Supervisory worker..	—	1	—	—	—	1
Common laborer.....	1	—	—	—	—	1
Factory operative and laborer.....	1	—	—	—	—	1
Professional men	—	—	—	—	1	1
No occupation ^b	—	—	—	—	1	1
Unknown	—	—	1	—	—	1
Total	7	2	6	1	9	25

^aFour of these husbands were unemployed.

^bWorld War Veteran without an occupation.

Table 93 classifies the occupation of the wife by the occupation of her husband. As may be noted, the husband's occupation was generally similar to that of his wife. For instance, of the seven daughters in unskilled and semi-skilled work, three had husbands who were drivers and carriers; one a husband who did common labor; and one was married to a factory operator and laborer. Of the six daughters who were managers, clerks and kindred workers, two had husbands who were salesmen; and one a husband who was a clerical worker. No professional woman was married to a driver and carrier, a common laborer, or a factory operator and laborer. From these few cases, one could conclude, it would seem, that women engaged in full-time non-agricultural pursuits are generally married to men of a similar occupational class.

Of what ages were the 62 daughters engaged in the different kinds of non-farm work? Was the younger group, as in the case of sons, more often doing unskilled and semi-skilled work, the older group work of other kind? Fifty

^aTwo of the married women "with non-farm occupations" were unemployed. These will not be included, of course, in this discussion.

^bSeveral of these women, however, had assistance in their housekeeping tasks.

percent of the daughters engaged in unskilled and semi-skilled work; 60 percent of the managers, clerks, and kindred workers; and 20 percent of the professional workers were 19-23 years of age.¹⁰ Daughters in professional work were usually teachers. The young girl recently out of school or college without experience has found it difficult to secure a position in the last few years. Therefore, it is not surprising that the greater number of the professional workers were 24-34 years of age (Table 94). It is interesting to note that the daughters with non-farm occupations were much younger than the sons with non-farm occupations. Twenty-two percent of the sons in work other than farming were 19-23 years of age; 35 percent of the daughters were in this age group. The main occupation of the majority of daughters is eventually housewife. Daughters who are gainfully employed before marriage generally discontinue their occupation at the time of marriage, or a short time thereafter. Consequently, it is not surprising that this group in which the majority were unmarried was made up so largely of younger women.

Table 94. Ages of Daughters with Non-farm Occupations Classified by Occupation

Occupation	Daughters of specified ages			
	19-23 years	24-28 years	29-33 years	All daughters
	Number	Number	Number	Number
Unskilled and semi-skilled laborers.....	8	6	2	16
Skilled laborers	—	2	2	4
Managers, clerks and kindred workers.....	9	3	3	15
Independent business women.....	—	—	1	1
Professional women	5	12	9	26
Total	22	23	17	62

Table 95. Education of Daughters with Non-farm Occupation Classified by Their Occupation

Occupations	Education of daughters				
	8th grade and under	High-school training	High-school graduate	College training	All daughters
	Number	Number	Number	Number	Number
Unskilled and semi-skilled laborers.....	3	8	4	1	16
Skilled laborers	1	2	1	—	4
Managers, clerks and kindred workers.....	—	9	5	1	15
Independent business women.....	1	—	—	—	1
Professional women	—	1	5	20	26
Total	5	20	15	22	62

The majority of daughters engaged in non-farm work having 8th grade schooling or less were unskilled and semi-skilled laborers (Table 95.) Unskilled daughters like unskilled sons, were more likely to be in the younger group, and the younger group of non-farm daughters were somewhat better educated. Therefore, the education of the unskilled shows up better in Table 95, because it is more heavily weighted with younger daughters. Daughters with high-school training or who have graduated from high-school were more frequently managers, clerks, and kindred workers in all age groups. All but six professional women had attended college. Four of these were trained nurses; the remaining were teachers.

¹⁰The percentage disagreement in the replies of the family and non-farming daughter was figured for the entire group of non-farming daughters, daughters with a non-farming occupation as well as non-farm homemakers. As only 83 of the non-farm daughters returned the questionnaire, it was thought best not to make a separate tabulation of the agreement and disagreement in the replies of the family and each type of non-farm daughter. There was a disagreement in the replies of the family and of all non-farming daughters concerning their main occupation, of 5 percent; concerning their secondary or supplementary occupation, of 5 percent; concerning age group, of 6 percent; concerning education group, of 10 per cent; and concerning occupational history, of 18 percent.

Table 96. Occupations of Daughters with Non-farm Occupations Classified According to Tenure of Parental Families 1934

Occupations	Tenure of parental family		
	Owners	Tenants	All daughters
	Number	Number	Number
Unskilled and semi-skilled laborers.....	11	5	16
Skilled laborers	3	1	4
Managers, clerks and kindred workers.....	12	3	15
Professional women	23	3	26
Independent business women.....	—	1	1
Total	49	13	62

Daughters of owners were more often professional women, while daughters of tenants were more often unskilled and semi-skilled laborers (Table 96). Daughters of tenant families, as has been shown, have fewer opportunities for securing work off the farm than have daughters of owners. For the majority of farm-reared girls, daughters of owners as well as of tenants, the choice of an occupation lies between working for one's father or for one's husband. However, this is a decision which must be made by the daughters of tenants more frequently than by the daughters of owners.

Lauderdale County had a larger proportion of daughters who were managers, clerks, and kindred workers, than the other four counties, due to the fact that this county contained a city providing opportunities for young women (Table 97). The relatively high proportion of daughters engaged in professional work from the families of Sunflower County was, of course, due to the better education of the daughters of the families in this county. Daughters from families in Jefferson Davis County and Lauderdale County was fairly equally distributed in three kinds of occupations. However, over one-half of the daughters from families in Jefferson Davis County were married women. Several of them lived in an adjacent county where non-farm work was more available. This was likewise true of daughters from families of Tate County. Few daughters from families of Webster County had non-farm work. The few who did were in professional work.

The spatial mobility of non-farm daughters had been much less than that of non-farm sons. Eighty-five percent of the daughters with non-farm occupations had worked in Mississippi since leaving school (Table 98), while fifty-eight percent of the non-farm sons had done so. The spatial mobility of daughters who were unskilled and semi-skilled laborers had been somewhat greater than that of daughters who were managers, clerks, and kindred workers and professional women. Unskilled, semi-skilled, and skilled work is avail-

Table 97. Occupations of Daughters with Non-farm Occupations Classified by the Counties in Which Their Parental Families Resided 1934

Occupations	Counties in which parental families resided					All daughters
	Jefferson Davis	Lauderdale	Sunflower	Tate	Webster	
	Number	Number	Number	Number	Number	Number
Unskilled and semi-skilled laborers	4	6	1	4	1	16
Skilled laborers	1	1	—	2	—	4
Managers, clerks and kindred workers	3	6	3	2	1	15
Professional women	3	6	10	2	5	26
Independent business women.....	—	—	—	1	—	1
Total	11	19	14	11	7	62

Table 98. Spatial Mobility Since Leaving School of Daughters with Non-farm Occupations^a

Occupations	Always worked:					
	In same position	In same town	In same county	In same state	Other ^b	All daughters
	Number	Number	Number	Number	Number	Number
Unskilled and semi-skilled laborers	—	4	2	7	3	16
Skilled laborers	—	—	—	2	2	4
Managers, clerks and kindred workers	2	6	—	4	3	15
Professional women	5	5	3	12	1	26
Independent business women	—	—	—	—	1	1
Total	7	15	5	25	10	62

^aThere was a disagreement of 10 percent in the replies of the family and daughter with non-farm occupation concerning spatial mobility. However, the number of cases was limited.

^bTwo or more states or countries.

able for women in only a few places in Mississippi. Therefore, women desiring this type of work are forced to go greater distances to find it.

In Table 99 the occupational histories of the 62 daughters engaged in non-farm pursuits are shown. As may be noted, these daughters had a total of 25 different combinations of occupational histories. These are somewhat fewer combinations than non-farming sons had had. There are, of course, many more different kinds of occupations open to men than there are to women and,

Table 99. Occupational Histories of Daughters with Non-farm Occupations
Classified by Their Occupations

Occupational histories	Kinds of occupations					
	Unskilled and semi-skilled laborers	Skilled laborers	Managers, clerks and kindred workers	Professional women	Independent business women	All daughters
	Number	Number	Number	Number	Number	Number
College; professional service	—	—	—	14	—	14
College; professional service; clerical service	—	—	4	1	—	5
Vocational course; professional service	—	—	—	4	—	4
Farm-home assistant; factory operative and laborer	4	—	—	—	—	4
Farm-home assistant; saleswoman	—	—	3	—	—	3
Farm-home assistant; housewife; personal service	2	1	—	—	—	3
Farm-home assistant; housewife; factory operative and laborer	2	1	—	—	—	3
Saleswoman only	—	—	3	—	—	3
College; professional service; housewife	—	—	—	2	—	2
Vocational course; clerical service	—	—	2	—	—	2
Vocational course; saleswoman; factory operative and laborer	1	—	1	—	—	2
Vocational course; personal service	2	—	—	—	—	2
Vocational course; clerical service; personal service	—	1	1	—	—	2
Vocational course; farm-home assistant; professional service	—	—	—	2	—	2
All other combinations ^a	5	1	1	3	1	11
Total	16	4	15	26	1	62

^aCombinations of occupations in which there was but one case.

therefore, one would expect the latter to have had less varied careers. Non-farm daughters had had a greater number of occupations since leaving school than had non-farm sons, but this is due to the fact that a relatively greater proportion of them had been to college or had had vocational courses. If such training is excluded from the occupational histories, sons engaged in non-farm work had had a greater number of occupations than had daughters in similar work. This would be expected as daughters with non-farm work were younger than sons with non-farm work.

It is interesting to note that the daughters with non-farm work had not had farm experience since leaving school as often as had sons with non-farm work (Table 99). These daughters who had spent some time as farm-home assistants were usually unskilled and semi-skilled laborers. The most striking thing in Table 99 is the large number of daughters in non-farm work who had had either college training or had taken a vocational course. Most of the non-agricultural work available in Mississippi for women requires such training.

Non-Farm Housewives

There were 114 daughters without a main gainful occupation married to men following non-farm pursuits at the time of the study. Only six of these daughters had a secondary or supplementary occupation. One clerked Saturdays; three did some sewing; and two kept a few boarders. This is much below the proportion of farm housewives having a supplementary or secondary occupation. However, there were few "odd" jobs for women in towns of Mississippi, where most of the group resided.

As may be noted from Table 100, younger daughters were more frequently married to unskilled and semi-skilled workers, older daughters to skilled workers, managers, clerks, and kindred workers, and independent business men. Relatively more younger daughters were married to professional men, but the number of cases is very limited. Younger daughters would be married to younger men and one would, therefore, expect the distribution of the occupations of sons-in-law according to the age of their wives to be similar to the distribution of the occupations of the sons according to their own age. This was the case.

There seemed to be a slight tendency for a relatively greater number of the better educated daughters to be married to men following occupations with higher social status (Table 101). That this tendency did not appear greater was due to the fact that the older non-farm housewives, or those 29-33 years of age, had the least education and relatively fewer of them were married to unskilled and semi-skilled laborers. It is interesting to note that there was no daughter with 8th grade schooling or under, married to a professional man,

Table 100. Age of Non-farm Housewives Classified by the Occupation of Their Husbands

Occupations of husbands	Daughters of specified ages							
	19-23 years		24-28 years		29-33 years		All daughters	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Unskilled and semi-skilled laborers	17	53.1	18	41.0	10	25.6	45	39.5
Skilled laborers	6	18.8	13	30.2	12	30.8	31	27.2
Managers, clerks and kindred workers	4	12.5	8	18.5	10	25.6	22	19.3
Independent business men	3	9.4	2	4.7	6	15.4	11	9.6
Professional men	2	6.2	2	4.7	1	2.6	5	4.4
Total	32	100.0	43	100.0	39	100.0	114	100.0

Table 101. Education of Non-farm Housewives Classified by the Occupations of Their Husbands

Occupations of husbands	Education of daughters				
	8th grade and under	High-school training	High-school graduate	College training	All daughters
	Number	Number	Number	Number	Number
Unskilled and semi-skilled laborers.....	12	23	10	—	45
Skilled laborers	11	9	11	—	31
Managers, clerks and kindred workers....	3	9	7	3	22
Independent business men.....	3	6	2	—	11
Professional men	—	4	1	—	5
Total	29	51	31	3	114
Percentage distribution					
Unskilled and semi-skilled laborers.....	41.5	45.1	32.3	—	39.5
Skilled laborers	37.9	17.6	35.5	—	27.2
Managers, clerks and kindred workers....	10.3	17.6	22.5	—	19.3
Independent business men.....	10.3	11.8	6.5	—	9.6
Professional men	—	7.9	3.2	—	4.4
Total	100.0	100.0	100.0	—	100.0

Table 102. Occupations of Husbands of Non-farm Housewives Classified by Tenure of Parental Families 1934

Occupations of husbands	Tenure of parental family					
	Owners		Tenants		All daughters	
	Number	Per cent	Number	Per cent	Number	Per cent
Unskilled and semi-skilled laborers	28	35.4	17	48.6	45	39.5
Skilled laborers	18	22.8	13	37.1	31	27.2
Managers, clerks and kindred workers	20	25.3	2	5.7	22	19.3
Independent business men	9	11.4	2	5.7	11	9.6
Professional men	4	5.1	1	2.9	5	4.4
Total	79	100.0	35	100.0	114	100.0

while there were twelve with this schooling married to unskilled and semi-skilled laborers.

Non-farm housewives who were daughters of land owners were more often married to men in occupations of high socio-economic status than were daughters of tenants (Table 102). Fifty-eight percent of the daughters of owners were married to laborers (unskilled, semi-skilled and skilled), while 86 percent of the daughters of tenants were married to men in these occupations. Daughters of owners were older women. Then, too, as has been repeatedly stated, the status of the daughters is dependent much more than that of the sons on the status of their parental family.

As may be noted from Table 103, relatively more daughters from Lauderdale, Sunflower and Tate County families were married to men who were managers, clerks and kindred workers, in professional work or owning their own business. Daughters in these three counties (the more urban) probably had more opportunity to meet men in these kinds of occupations. Very few daughters from families in Webster County were married to men in non-farm work; most of these were married to sawmill workers.

Nearly one-half of the non-farm housewives were farm-home assistants before they married; one-fourth left school to marry. Three were taking or had just completed a vocational course. One-fourth of the group, therefore, was engaged in a gainful occupation at the time of marriage. This is much

Table 103. Occupations of Husbands of Non-farm Housewives Classified by Counties in Which the Parental Families Resided 1934

Occupations of husbands	Counties in which parental families resided					
	Jefferson Davis	Lauderdale	Sunflower	Tate	Webster	All homemakers
	Number	Number	Number	Number	Number	Number
Unskilled and semi-skilled laborers	12	10	8	9	6	45
Skilled laborers	10	6	4	10	1	31
Managers, clerks and kindred workers	1	8	7	5	1	22
Independent business men	1	4	3	3	—	11
Professional men	1	3	—	1	—	5
Total	25	31	22	28	8	114
Percentage distribution						
Unskilled and semi-skilled laborers	48.0	32.3	36.4	32.1	75.0	39.5
Skilled laborers	40.0	19.3	18.2	35.7	12.5	27.2
Managers, clerks and kindred workers	4.0	25.8	31.8	17.9	12.5	19.3
Independent business men	4.0	12.9	13.6	10.7	—	9.6
Professional men	4.0	9.1	—	3.6	—	4.4
Total	100.0	100.0	100.0	100.0	100.0	100.0

Table 104. Occupations of Non-farm Housewives Before Marriage Classified by the Occupation of Their Husbands

Occupations of daughters before marriage	Occupations of husbands					
	Unskilled and semi-skilled laborers	Skilled laborers	Managers, clerks and kindred workers	Independent business men	Professional men	All husbands
	Number	Number	Number	Number	Number	Number
Farm-home assistant	25	12	10	6	—	53
Left school to marry	14	7	3	1	4	29
Clerical service	1	3	3	2	—	9
Professional service	1	2	4	—	1	8
Saleswoman	—	1	1	1	—	3
Vocational course	2	1	—	—	—	3
Factory operative and laborer	2	1	—	—	—	3
Personal and domestic service	—	2	1	—	—	3
Machine and related trades	—	1	—	1	—	2
Proprietress	—	1	—	—	—	1
Total	45	31	22	11	5	114

above the proportion of 6 percent of farm homemakers engaged in a gainful occupation at the time of marriage. More farm housewives than non-farm housewives had left school to marry. However, the most common occupation of both groups before marriage was that of farm-home assistant. In other words, the majority of girls in this study did gainful work neither before nor after marriage.

Sixty-two percent of the non-farm housewives had had no gainful occupation since leaving school, whereas about ninety percent of the farm housewives had had no gainful occupations since leaving school; or stating it more briefly, non-farm housewives had had, on the whole, more varied occupational experience than farm homemakers. Farm homemakers, however, had married earlier. Daughters married to managers, clerks, or kindred workers, had had the most varied occupational experience; daughters married to professional,

Table 105. Occupational Histories of Non-farm Housewives Since Leaving Public School
Classified by the Occupations of Their Husbands

Occupational histories	Occupations of husbands					
	Unskilled and semi-skilled laborers	Skilled laborers	Managers, clerks and kindred workers	Independent business men	Professional men	All husbands
	Number	Number	Number	Number	Number	Number
Farm-home assistant; housewife	23	11	5	7	—	46
Housewife only	12	6	2	1	4	25
Factory operative and laborer; housewife	2	3	—	—	—	5
Vocational course; housewife	3	1	—	—	—	4
Vocational course; professional service; housewife	1	2	1	—	—	4
Farm-home assistant; saleswoman; housewife	1	1	2	—	—	4
Vocational course; clerical service; housewife	1	1	1	1	—	4
Personal service; housewife	1	1	—	—	—	2
Saleswoman; housewife	—	1	1	1	—	3
Clerical service; housewife	—	2	1	—	—	3
College; professional service; housewife	—	—	1	—	1	2
Vocational course; farm-home assistant; housewife	—	—	2	—	—	2
Proprietress; housewife	1	1	—	—	—	2
All other combinations ^a	—	1	6	1	—	8
Total	45	31	22	11	5	114

^aCombinations of occupations in which there was but one case.

unskilled, and semi-skilled workers had had the least. However, there were only five daughters married to professional men. Relatively more of the older daughters were married to managers, clerks, or kindred workers than to unskilled and semi-skilled workers; this fact would account at least in part for their more varied occupational careers.

CHAPTER IX.

PART-TIME FARMING SONS AND DAUGHTERS

The third and last occupational group, part-time farming sons and daughters, remains to be discussed. This group, as will be recalled, is composed of the sons and daughters who were regularly engaged in both farming and other pursuits, and of the daughters married to men regularly engaged in both farm and non-farm pursuits.

Part-time Farming Sons

There were in this study 516 sons who did some farming, but only 65 of these combined farming with another regular occupation. In other words, the majority of the men in the study who did any farming at all farmed full time. How was the small group who was farming part-time faring? Was farming their main or their secondary occupation? As may be noted, the main occupation of nearly three-fourths was farming (Table 106). The main occupation of only one-fourth, or 17, was work off the farm. It is very significant that so few of this group were combining a major non-farm occupation with farming. It will be shown shortly that this is due to lack of rural industries in the state.

"Drivers and carriers", "factory operatives and laborers", and "laborers in the machine and related trades" were the occupations usually combined with farming; these three occupational groupings included 72 percent of the part-time farmers. "Drivers and carriers" were usually road maintenance men; "factory operatives and laborers" were, as a rule, sawmill workers; and those in "machine and related trades" were generally mechanics or carpenters. These were the three occupations which most often furnished additional work to farmers.

Table 106. Farm Tenure of Sons with Main Occupation Farming Classified by Their Secondary Occupation

Secondary occupation	Farm tenure of sons ^a				
	Owners	Tenants	Wage workers	Non-cash assistants	Total
	Number	Number	Number	Number	Number
Driver and carrier.....	3	18	2	—	23
Factory operative and laborer....	2	8	—	—	10
Machine and related trades.....	—	5	—	2	7
Salesmen	2	—	—	—	2
Professional service	—	1	—	1	2
Domestic and personal service ..	—	1	—	1	2
Common labor	—	1	—	—	1
Soldiers, sailors, policemen, etc.	—	1	—	—	1
Total	7	35	2	4	48

^aNo managers in this group.

Table 107. Occupations of Sons with Main Occupation in Non-farm Pursuits Classified by Their Farm Tenure

Main occupation	Farm tenure of sons ^a				
	Owners	Tenants	Wage workers	Non-cash assistants	Total
	Number	Number	Number	Number	Number
Driver and carrier.....	1	3	—	—	4
Supervisory service	1	1	—	—	2
Clerical service	1	—	—	1	2
Salesman	1	1	—	—	2
Machine and related trades.....	—	2	—	—	2
Common labor	1	1	—	—	2
Professional service	—	—	1	—	1
Proprietor	—	1	—	—	1
Factory operative and laborer....	—	—	1	—	1
Total	5	9	2	1	17

^aNo managers in this group.

The secondary occupation of 23 of the 48 part-time farming sons whose main occupation was farming was driver and carrier. As has been previously mentioned, this kind of work more than any other work furnishes main and secondary occupations for the men living in the rural districts of Mississippi.¹ This has been especially true in the last few years, since sawmilling has decreased in importance as an occupation. Next to sawmilling in importance as a secondary non-farm occupation was carpentry and mechanic work. One found in the rural districts of Mississippi quite a number of men who had very

¹Since many of these drivers and carriers were engaged in the upkeep of graveled roads, this is used by some as an argument against replacing graveled with concrete roads. However, concrete roads would without doubt mean less wear and tear upon automobiles, thus releasing the money formerly spent for new parts or new automobiles for other purposes. Then, too, better roads might result in more tourists coming into the state. The possible additional employment resulting from a change in the type of roads might not immediately benefit those men who had earned by caring for graveled roads. Indeed, many would find it difficult to find other means of supplementing their farm income.

happily combined these occupations with farming. Several fathers were found who followed the carpentry trade in youth and who, after marriage and the arrival of children, had settled on a farm to confine their trades to their own farms. One or more sons of such families were likely to be employed in the building or mechanic trades.

About 88 percent of the part-time farming sons whose main occupation was farming were farm operators; while in the case of the full-time farmers² 62 percent were operators (Table 108). The part-time farming group not only contained proportionally more farm operators, but also contained more land owners than did the full-time farming group. Seven percent of the full time farming sons were land owners, while 15 percent of the part-time farming sons were land owners. There were more of the sons with secondary non-farm occupations who were renting land from relatives (which generally means that the son will inherit land); more owned their own stock; more did not have a mortgage on their farms. One can thus conclude that on the whole the group with a regular occupation in addition to farming had a somewhat higher economic status. The number of cases, however, is too limited to make the findings altogether conclusive.³

The farms operated by sons with a secondary non-farm occupation were larger than those operated by full time farming sons (Table 109). Sixty-nine

Table 108. Farm Tenure and Financial Status of Farming and Part-time Farming Sons^a Compared

Farm tenure and financial status	Farming sons		Part-time farming sons	
	Number	Per cent	Number	Per cent
Farm operators	278	61.7	42	87.5
Owners	30	6.7	7	14.5
Farm mortgaged	13	2.9	2	4.2
Farm not mortgaged	17	3.8	5	10.3
Managers	10	2.2	—	—
Tenants	238	52.8	35	72.9
Relatives' land rented	85	18.8	16	33.3
Own work stock	55	12.2	11	22.9
Do not own work stock	30	6.7	5	10.4
Non-relatives' land rented	153	33.9	19	39.6
Own work stock	104	23.1	14	29.2
Do not own work stock	49	10.8	5	10.4
Farm laborers	173	38.3	6	12.5
Wage workers	77	17.1	2	4.2
Work for relatives	64	14.2	2	4.2
Do not work for relatives	13	2.9	—	—
Non-cash assistants	96	21.4	4	8.3
Total	451	100.0	48	100.0

^aThose with the main occupation farming.

Table 109. Number of Mules Worked by Farming and Part-time Farming Sons Compared

Number of mules worked	Farming sons		Part-time farming sons	
	Number	Per cent	Number	Per cent
1 mule	216	80.6	29	69.0
2 mules	42	15.6	11	26.4
3-4 mules	5	1.9	1	2.3
5 mules and over	5	1.9	1	2.3
Total	268	100.0	42	100.0

²In the succeeding discussion the term "full-time farming" will be used for "farming". This is to differentiate it more clearly from "part-time farming."

³In checking the agreement and disagreement in the data obtained from the parental family and sons and daughters, the sons and daughters were classified by their main occupations as the number of returns from those who were engaged in both activities was limited. Therefore, any disagreements found in the data of the farming group would apply to the group whose main occupation was farming, and conversely any disagreement found in the data of the non-farming group would apply to the group whose main occupation was not farming.

percent of the former were 1-mule farms, while 81 percent of the latter were 1-mule farms. The larger farm may have been due to the fact that these operators had an additional cash income coming in regularly. Thus it was possible to hire a wage hand or finance a tenant family or, as naturally follows to operate a larger farm. On the other hand, the part-time employment may be because of the larger farm, more owners and, therefore, more political influence.

Those part-time farming sons whose major occupation was in non-agricultural pursuits were fairly evenly distributed among six occupations, though the number of drivers and carriers was somewhat greater than any of the others. Mississippi is so rural that it offers few opportunities to its young people for combining non-farm work as a major activity with that of farming as a minor activity.

Many rural life leaders believe that farming in the future will be widely different from that of the present. They see a greater mechanization of the main types of farming and full-time commercial farming limited to a small group. A large proportion of those who now farm on the full-time basis, they believe, will combine it with non-farm work in the future. The development of rural industrial communities will increase greatly the number of part-time farmers who have their main occupation in non-agricultural pursuits, but who also cultivate a few acres and milk a few cows. Such industrial development will mean an improved standard of living for the youth reared on Mississippi farms, for much of the farming now carried on in the state by full-time farmers provides little more than subsistence. As has been pointed out more than once, Mississippi is sadly in need of industries that fit well into the farm program—industries that will increase the cash incomes of its rural folk.

What are the characteristics of this group of part-time farming sons? Are they a more mature group than the full-time farming sons? Are they better educated? Table 110 gives a comparison of the ages of these two groups. Part-time farming sons were older than full-time farming sons. As may be noted, the age distribution of the part-time farmers followed more closely that of non-farmers than of full-time farmers, about 45 percent of the part-time farmers being 29-33 years of age and about 37 percent 24-28 years of age. There were relatively more farm operators in the part-time farming group than in the full-time farming group. Therefore, it is not surprising that part-time farmers were older, for it has been shown that older sons were more likely to be farm operators.⁴

Of the part-time farming sons whose main occupations were in work off the farm, eight were doing unskilled and semi-skilled labor. Four, or one-half, of these were 29-33 years of age. As will be recalled, the proportion of non-farming sons in unskilled and semi-skilled work decreased greatly with age. The fact that a higher proportion of older sons in the part-time farming group were combining unskilled labor with farming may be due to the limited number of jobs available for those who want to remain on the farm.

Table 110. Ages of Part-time and Full-time Farming Sons Compared

Occupational group	Sons 19-23 years		Sons 24-28 years		Sons 29-33 years		Total	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Part-time farming sons	13	5.9	24	12.7	28	26.7	65	12.6
Main occupation farming	7	3.2	21	11.1	20	19.0	48	9.3
Main occupation non-farming	6	2.7	3	1.6	8	7.7	17	3.3
Full-time farming sons	209	94.1	165	87.3	77	73.3	451	87.4
Total	222	100.0	189	100.0	105	100.0	516	100.0

⁴Table 66, p. 63.

There were relatively more part-time than full-time farmers married. This is to be expected, as the part-time farming group was older. Then, too, married farmers have a greater incentive to seek additional sources of income. Of the two part-time farming groups, the group whose main occupation was farming was more often married (Table 111).

Table 111. Married and Unmarried Part-time and Full-time Farming Sons Compared

Group	Married sons		Unmarried sons		All sons	
	Number	Per cent	Number	Per cent	Number	Per cent
Part-time farming sons.....	48	16.7	17	7.5	65	12.6
Main occupation farming	39	13.5	9	3.9	48	9.3
Main occupation non-farming	9	3.2	8	3.6	17	3.3
Full-time farming sons.....	240	83.3	211	92.5	451	87.4
Total	288	100.0	228	100.0	516	100.0

Table 112. Education of Part-time and Full-time Farming Sons Compared

Group	Education of sons				
	8th grade and under	High school training	High school graduate	College training	All sons
	Number	Number	Number	Number	Number
Part-time farming sons.....	30	22	6	7	65
Main occupation farming	23	17	5	3	48
Main occupation non-farming	7	5	1	4	17
Full-time farming sons	266	125	40	20	451
Total	296	147	46	27	516

Percentage distribution

Part-time farming sons.....	10.1	15.0	13.0	25.9	12.6
Main occupation farming	7.8	11.6	10.9	11.1	9.3
Main occupation non-farming	2.3	3.4	2.1	14.8	3.3
Full-time farming sons	89.9	85.0	87.0	74.1	87.4
Total	100.0	100.0	100.0	100.0	100.0

Relatively more part-time farmers than full-time farmers had college training; and similarly part-time farmers whose major occupation was in non-agricultural work had a better education than the other group of part-time farmers (Table 112). Of the 8 part-time farming sons whose main occupation was in the unskilled and semi-skilled trades, six had not reached high school. None of the five part-time farming sons whose main occupation was manager, clerks and kindred workers had had so little schooling. This is similar to what was found in respect to the education of sons engaged full-time in these two kinds of non-farm occupations.

Table 113. Tenure of the Parental Families in 1934 of Part-time and Full-time Farming Sons Compared

Group	Tenure of parental family					
	Owners		Tenants		All sons	
	Number	Per cent	Number	Per cent	Number	Per cent
Part-time farming sons.....	44	17.9	21	7.8	65	12.6
Main occupation farming	34	13.8	14	5.2	48	9.3
Main occupation non-farming	10	4.1	7	2.6	17	3.3
Full-time farming sons	202	82.1	249	92.2	451	87.4
Total	246	100.0	270	100.0	516	100.0

As may be noted in Table 113, relatively more sons of owners were part-time farmers than were sons of tenants. For both sons of owners and sons of tenants, there was a greater percentage of part-time farming sons whose main occupation was farming than those whose main occupation was non-farming; but in this respect, the percentage of sons of owners was greater than the per-

centage of sons of tenants. Perhaps more sons of landowners would enter agricultural pursuits if there were more secondary non-farm jobs to be secured or more opportunities for supplementing the earnings from the farm. If or when this opportunity occurs, the number of owner sons entering the occupation of farming may increase.

There were relatively more part-time farming sons of families from Lauderdale and Webster Counties than of families in the other three counties studied. The main occupation of the part-time farming sons from Lauderdale County was most often in non-farm pursuits, while in Webster County it was most often in farm pursuits. As has been previously mentioned, Lauderdale County contains a city which gives employment, full-time as well as part-time, to many of its rural young people. The sons of Webster County families often combined farming and sawmilling. However, many of the wooded lands in this county have been stripped and sawmilling does not provide the employment it once did. Several people mentioned the fact that the decline of sawmilling had caused to a large extent the migration of Webster County people to the Delta. Webster County contains such a large amount of submarginal

Table 114. Counties in Which the Parental Families of Part-time and Full-time Farming Sons Resided in 1934 Compared

Group	Parental family resides in					
	Jefferson Davis	Lauderdale	Sunflower	Tate	Webster	All sons
	Number	Number	Number	Number	Number	Number
Part-time farming sons.....	14	13	10	10	18	65
Main occupation farming.....	10	8	6	8	16	48
Main occupation non-farming.....	4	5	4	2	2	17
Full-time farming sons.....	126	78	84	68	95	451
Total	140	91	94	78	113	516
Percentage distribution						
Part-time farming sons.....	10.0	14.3	10.6	12.8	15.9	12.6
Main occupation farming.....	7.1	8.8	6.4	10.3	14.1	9.3
Main occupation non-farming.....	2.9	5.5	4.2	2.5	1.8	3.3
Full-time farming sons.....	90.0	85.7	89.4	87.2	84.1	87.4
Total	100.0	100.0	100.0	100.0	100.0	100.0

Table 115. Spatial Mobility of Part-time and Full-time Farming Sons Since Leaving Public School Compared

Group	Always worked since leaving school:					All sons
	On same farm or in same position	In same community or town	In same county	In same state	Other ^a	
	Number	Number	Number	Number	Number	Number
Part-time farming sons.....	10	11	14	16	14	65
Main occupation farming.....	9	8	9	12	10	48
Main occupation non-farming.....	1	3	5	4	4	17
Full-time farming sons.....	124	86	79	123	39	451
Total	134	97	93	139	53	516
Percentage distribution						
Part-time farming sons.....	7.5	11.3	15.2	13.0	26.4	12.6
Main occupation farming.....	6.7	8.1	9.7	8.6	18.9	9.3
Main occupation non-farming.....	.8	3.2	5.5	4.4	7.5	3.3
Full-time farming sons.....	92.5	88.7	84.8	87.0	73.6	87.4
Total	100.0	100.0	100.0	100.0	100.0	100.0

^aIn more than one state or country.

land that it is in special need of industries to supplement the occupation of farming which is at present usually of a subsistence type.

The spatial mobility of the part-time farming sons since leaving school had been greater than that of the full-time farming sons. More of the former had worked out of the state. About 46 percent of the full-time farming sons had always worked on the same farm or in the same community, while only 33 percent of the part-time farming sons had done so. Similarly the spatial mobility of the part-time farming group whose major occupation was in non-agricultural work was greater than the group whose major occupation was in agricultural work, though not markedly so (Table 115). The main difference was in the number who had always worked "on the same farm or in the same position", this number being much greater for the group whose main occupation was farming.

Part-time farming sons had had more varied occupational histories than had full-time farming sons. Fifty-two percent of the part-time farming sons had had only one occupation; 29 percent had had two occupations; 15 percent had had three occupations (Table 116). Seventy-six percent of the full-time farming sons had had only one occupation; 17 percent, two occupations; and 5 percent, three occupations. Part-time farming sons had had more occupations than had full-time farming sons, but not so many occupations as had non-farming sons. In other words, the occupational careers of the part-time farming group can be classed as intermediate, neither so varied as the non-farm group nor so lacking in variety as the farm group. Part-time farming sons whose main occupation was farming had had relatively fewer occupations than those whose main occupation was in non-agricultural pursuits (Table 116). Thirty sons of the former group had had only one main occupation, while only four sons of the latter group had had only one main occupation.

Table 116. Occupational Histories of Part-time Farming Sons Classified by Main Occupation

Occupational histories ^a	Main occupation		
	Farming	Non-farming	All sons
	Number	Number	Number
Farming always	30	—	30
Farming; machine and related trades.....	6	1	7
Farmer; common laborer.....	2	2	4
Factory operative and laborer; farmer; common laborer	3	—	3
Salesman; farmer	1	1	2
Driver and carrier; farmer.....	2	—	2
Salesman only	—	2	2
All other combinations ^b	4	11	15
Total	48	17	65

^aMain occupation only.

^bCombinations of occupations in which there was but one case.

Part-time Farming Daughters

As has been stated there were two types of part-time farming daughters, those who derived their classification from their own part-time work and those who derived their classification from their husbands occupation. In the first class there were 18. Eight of these were E. R. A. home visitors; five had E. R. A. school lunch work; two were E. R. A. teachers. Only two had work other than work relief. One of these clerked on Saturdays. The other was a part-time dressmaker. The work relief provided these women meant a great deal to them. As one of the farm-home assistants doing home visiting aptly put it, "Even this little job means so much to my morale to say nothing of my pocket book." Often a part-time job is a desirable alternative to migrating elsewhere in search of a full-time job. It is the only kind of work that those

needed on the farm a part of the year or a part of the time can accept. For every person securing such work there were dozens applying and it was a great pity that the Federal set-up provided so few regular jobs for rural women. Rural girls and women of Mississippi are certainly in need of more non-farm work. Many have few household responsibilities, few have paying occupations. Often part-time work would make a difference between mere existence as many are now living, and a reasonably satisfactory life.

The second group of part-time farming daughters were those married to men combining farming and non-farming. There were about the same number of husbands having farming as their major occupation as there were husbands having farming as their minor occupation. This was not true in the case of part-time farming sons. There were more than twice as many whose main occupation was farming. It seems probable that the parental family may have failed to give the required information about the secondary non-farm occupation of the sons-in-law more frequently than about the sons.

Table 117. Main Occupation of Husbands of Daughters Married to Part-time Farmers

Main occupation	Number
Farmer	14
Driver and carrier	3
Salesman	2
Common laborer	2
Professional service	2
Soldier, sailor, policeman, etc.	1
Proprietor	1
Machine and related trades	1
Total	21

There was no check on the accuracy of the data obtained about sons-in-law. At any rate, the occupation which the parental family reported that the sons-in-law were combining with farming were similar to those reported for the son. Drivers and carriers and factory operatives and laborers were the occupations most frequently reported for both groups.

Not only were questions pertaining to the daughters gainful employment asked of the family but also questions concerning their non-gainful work; that is, whether or not they worked in the field, did farm and housework. It seemed desirable to determine to what extent part-time farming daughters did non-gainful work of this kind and whether they did it less frequently than did full-time farming daughters.

There was little difference in the proportion of farm homemakers with and without secondary non-farm occupations who worked in the field, 63 percent of the former group and 64 percent of the latter group doing this kind of work (Table 118). Fewer daughters married to part-time farmers did field work than daughters married to full-time farmers. From the foregoing it would seem that the occupation of the husband rather than that of his wife largely determines whether she will work in the field or not. However, there was a high percentage of disagreement on this point in the data obtained from the parental family and the daughters.⁵ Then, too, the number of cases is limited. Therefore, the findings concerning the field work done by the married daughter cannot be considered significant.

Farm-home assistants with no secondary non-farm occupation worked in the field more frequently than those with a secondary non-farm occupation. Data from this group, as has been shown, are fairly accurate, as these daughters lived at home and many were present at the interview. Eighty-eight per-

⁵There was a 20 percent disagreement in the replies of the family and daughter as to whether or not she did field work. See Appendix A, p. 110.

Table 118. Non-gainful Work Done by Part-time Farming Daughters and Full-time Farming Daughters Compared

Occupational classification of daughters	Field work	No field work	Dairy garden and poultry work	No dairy, garden and poultry work	House work	No house work
	Number	Number	Number	Number	Number	Number
Homemakers without secondary						
non-farm occupation	226	127	343	10	352	1
Married to full-time farmers..	214	113	320	7	327	—
Married to part-time farmers	12	14	23	3	25	1
Homemakers with secondary						
non-farm occupations	5	3	7	1	8	—
Farm-home assistants	108	18	118	8	126	—
No secondary non-farm						
occupation	102	14	110	6	116	—
Secondary non-farm						
occupation	6	4	8	2	10	—
Total	339	148	468	19	486	1

Percentage distribution

Homemakers without secondary						
non-farm occupation	64.0	36.0	97.2	2.8	99.7	.3
Married to full-time farmers..	65.4	34.6	97.9	2.1	100.0	—
Married to part-time farmers	46.2	53.8	88.5	11.5	96.2	3.8
Homemakers with secondary						
non-farm occupations	62.5	37.5	87.5	12.5	100.0	—
Farm-home assistants	85.7	14.3	93.7	6.3	100.0	—
No secondary non-farm						
occupation	87.9	12.1	94.8	5.2	100.0	—
Secondary non-farm						
occupation	60.0	40.0	80.0	20.0	100.0	—
Total	69.6	30.4	96.1	3.9	100.0	—

cent of those without a secondary non-farm occupation worked in the field, while only 60 percent of those with a secondary non-farm occupation worked in the field. However, this difference was without doubt due at least partly to the fact, as will be shown later, that the farm-home assistant with gainful work was better educated and more often came from homes of landowners or was, in brief, a member of a group who least often worked in the field. Without doubt some of these young women would not have worked in the field even if they had not had gainful employment.

A larger proportion of all occupational classes did dairy, garden, and poultry work than did field work, though the daughters with secondary non-farm occupations less often did this work than those without secondary occupations. Daughters without gainful occupations married to part-time farmers likewise did dairy, garden and poultry work less often than did the daughters without gainful occupations married to full-time farmers.

All farming daughters, married and unmarried, doing full-time and part-time farming, did some housework. There is, of course, no fixed time for household tasks. Then, too, it is customary for women to do the housework, no matter what other work they may do. Part-time workers, however, can carry household tasks with less difficulty than can full time workers and it is part-time employment that many women and girls on the farm seriously need. Indeed, the typical farm family is more in need of increased cash income than of increased services of its women and girls.

Daughters (married or single) with secondary non-farm work were better educated and more often daughters of landowners than were daughters depending entirely on the farm for their livelihood. Landowners have more influence in the community and often use this influence to obtain a position for

their daughters. Their daughters have more education and are thus more likely to meet the requirements of available positions.

Married daughters whose occupational histories showed non-farm experience were more often engaged in part-time work than those who had not had such experiences (Table 120 and 121). However, only one farm-home assistant out of 10 had had a main gainful occupation since leaving school. As has been stated the farm-home assistantship group is one practically devoid of gainful employment history.

Table 119. Occupational History Since Leaving School of Farm Homemakers with Secondary Non-farm Occupations

Occupational history	Number
Farm-home assistant; housewife.....	2
College; professional service; housewife.....	1
Personal service; housewife.....	1
Machine and related trades; housewife.....	1
Professional service; housewife.....	1
Vocational course; farm-home assistant; saleswoman; housewife.....	1
College; housewife.....	1
Total.....	8

Table 120. Occupational History Since Leaving School of Farm Homemakers Married to Part-time Farmers

Occupational history	Number
Farm-home assistant; housewife.....	12
Housewife only.....	10
Professional service; housewife.....	3
College; housewife.....	1
Total.....	26

Table 121. Occupational History Since Leaving School of Farm-Home Assistants With Secondary Non-farm Occupations

Occupational history	Number
Farm-home assistant only.....	8
College; farm home assistant.....	1
Factory operative and laborer; saleswoman; professional service; farm-home assistant.....	1
Total.....	10

CHAPTER X.

THE OCCUPATIONAL SITUATION OF THE HANDICAPPED, THE WIDOWED, AND THE DIVORCED SONS AND DAUGHTERS

This chapter will concern the physically and mentally handicapped and the widowed and divorced sons and daughters not included in the occupational analysis in the preceding chapters. As previously stated, it was thought that such conditions as the foregoing might constitute a vocational handicap and for this reason the individuals in these classes are considered separately. The pertinent question in connection with these sons and daughters is: What is their occupational situation and to what extent has it been affected by their physical or mental handicaps or their marital conditions?

Physically and Mentally Handicapped Sons and Daughters

As stated in Chapter III, the physically or mentally handicapped included: (1) those who were permanently physically or mentally handicapped; (2) those who were unable to carry on a normal occupational life because of some

mental or physical condition. There were 51 such individuals in this study.¹ Thirty-four of them were men and 17 were women. Thirteen or about 25 percent of the group were totally incapacitated; that is, they were not able to perform any of the tasks usually performed by sons and daughters living at home. Of the 8 totally incapacitated sons, 3 were crippled, 2 had chronic diseases, 2 mental defects, and 1 was a drug addict. All five of the totally incapacitated daughters had mental defects.² Two were in the insane hospital and one had just returned from the insane hospital at the time of the interview with her family. One daughter was feeble-minded, another had "spells", and was not asked to do anything about the home.

About three-fourths of the physically and mentally handicapped sons and daughters did assume at least a few occupational duties. In fact, some of the group were apparently leading normal occupational lives. Especially was this true of the crippled and those with defects of the eyes. One-third, or the greatest number, of the handicapped children in this study were crippled.³ Nearly one-fifth were partially blind or had very abnormal eye conditions. Typical of those who seemed to be having normal occupational careers were P and Q. P, partially blind, after having taught school several years, married a farmer. At the time of the study, she did all her housework, cared for her children, and looked after the poultry and garden. Q, a cripple, was a farm tenant and "occasionally picked up a little saw-milling".

Though the occupational careers of a few of the handicapped were apparently normal, the occupational careers of the group as a whole differed quite a bit from the group without handicaps. Of the 26 handicapped sons who were able to make some contribution to their support, 22, or the great majority, were farming. Only 4 were in non-agricultural pursuits. Of the 12 handicapped daughters, 7 were farm-home assistants; 3 were farmers' wives; and 2 were engaged in non-farm work.⁴ In other words a larger proportion were farming than in the group without handicaps.

The majority of physically and mentally handicapped sons and daughters who could make any contribution at all toward their upkeep were non-cash farm assistants, and farm-home assistants. Both had the status of children in their families, a status normally held by the young. Yet this handicapped group was a relatively older group than was the group included in the main study. The fact that so few handicapped sons were farming independently was due to the fact that farming on one's own is too strenuous work for many with physical handicaps, or that it requires more managerial ability than a mental defective is able to give it. The fact that so few handicapped daughters were housewives is due to the fact that they are less likely to marry than are daughters without handicaps.

What many of the handicapped children need more than anything else is training to earn their livelihood in an occupation suited to their capacity. The Civilian Rehabilitation Department of the Department of Vocational Edu-

¹See Tables 130 and 131, pages 131, 132, for a classification of the occupations of these sons and daughters according to their handicaps.

²The fact that there were no daughters crippled or with chronic diseases classified as totally incapacitated may be due to the fact that there are more tasks around the home than around the farm that a severely handicapped person can do.

³In a survey made of 368,898 families in Mississippi in 1934, by Miss Susie V. Powell, 50 percent of the handicapped group were cripples. However, in her survey she did not count chronic diseases as handicaps and one would consequently expect her percentage of cripples to be higher. Susie V. Powell, *Survey for Rehabilitation of Handicapped Persons, 1934*, Mississippi Department of Public Welfare (unpublished Report).

⁴The two daughters with non-farm work were both cripples. Both were stenographers. One of them had an arrested case of tuberculosis of the bone. The Civilian Rehabilitation Department of the Department of Vocational Education had provided her with funds to take a business course and had secured employment for her afterwards.

cation renders this service, but has not been able to assist the majority in need of such aid, so inadequate are its appropriations. However, with the Federal subsidy provided in the Social Security Bill which has recently passed Congress, more adequate provision will undoubtedly be made for the handicapped in Mississippi than has been made in the past.

That so many of the handicapped were assisting at home was, however, not entirely due to physical or mental handicaps. The fact that the group as a whole was one with little schooling was no doubt partly responsible for the situation. Only 40 percent of the handicapped sons and daughters had had more than elementary school education. This, of course, increased their difficulty in finding a suitable occupation.

The limited education of the handicapped group was due to a number of causes. Some of the handicapped children had to withdraw from school at an early age because of their handicap. Oftentimes the child was so badly crippled that he could not walk even a fourth of a mile to meet the school bus. Then, too, some dropped out of school because of sensitiveness. One mother whose son had epilepsy said, "My boy was smart and liked school, but he was always having a spell and making himself conspicuous. That's why he quit."

However, the little schooling obtained by the handicapped was without doubt due more often to the low economic status of the parental family than to the inability of the child to get to school, or to get his sensitiveness about his handicap. The parental families of the handicapped who were landowners were more often paying for their farms during the school period of their children than were the parental families of the group without handicaps. In the handicapped group the proportion of parental families who were sharecroppers was larger than in the non-handicapped group. As has been stated, the share cropper stands on a lower rung of the "agricultural ladder" than does any other farm operator. The parental families of this unfortunate group had more illnesses than did those of the group without handicaps, and less money with which to meet these expenses. Under such circumstances it is not surprising that their children receive less schooling. Indeed many of this group were handicapped doubly, socially as well as physically or mentally.

Low economic status of the parental family had, however, a more serious effect upon the handicapped children than reduced schooling. Indeed, it was sometimes responsible for the handicap itself. Many of these handicapped persons would be normal today had they received adequate attention when it was most needed. The experience of R and S is typical of what often happens in very poor or very ignorant rural homes when an injury occurs. R's mother left him in a big chair by the fire when he was a baby (she had a very busy day ahead of her). R fell into the fire and was badly burned and crippled. The family had no money to pay hospital bills. R, now grown, is scarred and crippled. S broke his leg when he was 14 years old. His parents had it set, but it never grew back correctly and he is a cripple.

The greatest need of young people with handicaps is a definite place in the world; that is, they need a way of getting into the occupation which they can do best. For some this occupation may be farming. Indeed, it is in farming that some of them can make their best contribution. However, for others, farming is an unsuitable occupation. All types of non-farm work are not equally suitable. For instance, a son with one eye was a driver and carrier. Another subject to epileptic fits was a fireman at a logging camp, an occupation, it would seem, that is quite dangerous for a person with such a defect. At the time of the study handicapped persons had even less chance to choose their occupation than had non-handicapped persons. Consequently more of the handicapped were found in farming, the most available occupation.

Widowed and Divorced Sons and Daughters

The second class of sons and daughters excluded from the main study were the widowed and divorced. As previously indicated, this group included a total of 34 persons or about 2 percent of the total number of young people in the study.⁵ Nine of the 14 sons in the group were divorced; 5 were widowers.⁶ Eleven of the daughters were divorced; 4 were widows; 3 had invalid husbands; and 2 were unwed mothers.⁷ Daughters with invalid husbands were classified as housewives; unwed mothers as farm-home assistants. Nine of the widowed and divorced sons were farmers, 5 were engaged in non-farming pursuits.⁸ While 12 of the widowed and divorced daughters were farm-home assistants, 1 was a farmer; 3 were housewives; and 4 had non-agricultural work. In other words, in non-farm occupations, there were proportionally more widowed and divorced sons and daughters than those not widowed and divorced. The number of cases is, of course, limited.

The greatest difference, however, in those widowed and those divorced and not widowed and divorced was not in the relative numbers farming, but in the proportion living in the parental home. There were relatively more widowed and divorced sons and daughters than those not widowed and divorced at home, assisting on the farm and in the home. Forty-three percent of the widowed and divorced sons lived at home, while only 13 percent of the married sons lived at home. Sixty percent of the widowed and divorced daughters lived at home, while only 6 percent of the married daughters lived at home.

As a rule, when the daughter loses her husband by death or divorce, she returns to her parental family. Especially is this true if she is without funds or gainful work, which is generally the case. The stories of T and U well illustrate what often happens under such conditions. T, the oldest daughter of a cropper family, married a young man who had never been known to work. T now has two children, one 2 years old and the other 2 months old. Shortly before the birth of the second child she left her husband and went to a brother's. The brother is a cropper and has a large family, but he could not turn his sister away. T has applied for relief. U, the 18-year-old daughter of a tenant farmer, married and left for the city. Six months after she had

⁵The 1930 census returns for Mississippi showed that 4.4 percent of the white males and 8.4 percent of the white females in the state were widowed and divorced. The group in this study, however, is a restricted group of young people, while the census figures include all persons 15 years and over.

⁶Widowers and widows are men or women who have lost their spouse by death and who have not married again.

⁷Birth rates of illegitimate children from the State Board of Health indicate that in all probability some of the unwed mothers included in this study were not thus classified. However, this is not surprising, for: (1) no question concerning the children of daughters was asked the parental family. The information that two unmarried daughters had children was inadvertently obtained. When the investigator filled out the family record, if she saw any child around not accounted for, she would ask whose it was. In two cases she was told the child was that of an unmarried daughter; (2) even if the question had been asked directly of each family, it is doubtful that accurate information would have been obtained, for this is a fact that families are likely to conceal.

For the purpose of this study it is fortunately not necessary to know all the unmarried daughters with children, but only those who have their child or children with them and are responsible for the care of them. It seems likely that the occupational situation of the unmarried daughters with dead children, children in institutions, or children with other relatives—especially when this is not generally known in the community—may not differ greatly from that of single women. In view of this, it would seem safe to assume that in the 500 families of this study, there were few unmarried mothers with children in their custody. Consequently, misclassification on this score would have no significant effect upon the results of the study. Some of the divorced may belong in the unwed-mother category, as women not infrequently tell a story of marital unhappiness instead of stating the actual relationship under which they have been living. In this case, however, the category in which the daughter is placed would be the same.

⁸See page 132, Tables 132 and 133 for a classification of the occupations of the widowed and divorced sons and daughters.

been married, her husband went on a business trip and never returned. At the time of the study U was at home with her 2-year-old daughter. Her people had failed to get a farm the preceding year and had sent their other two children to live with relatives. In the year of the study they had secured a farm, but were scarcely making ends meet. They, of course, divided the little they had with U and her child.

The majority of widowed and divorced daughters were at home with their parents, assisting in the housework and on the farm. The divorced daughter was not found with a non-farm occupation as frequently as the widowed daughter. Securing work is more difficult for a divorcee than for a widow, especially in communities such as those in which this study was made where there are so few non-farm jobs available for women.

Some of these young women were very much in need of gainful work in close proximity to their homes. Some had young children to support. The majority of the parental families can afford to board their daughter and her children, but few have ready cash for clothing, school books, and the like. If the daughter could secure a part-time job, this would relieve her family greatly. Most of the parental families can much more easily give physical care to their grandchildren than provide the cash to purchase clothing, school books, and other necessities.

Few of the widowed and divorced were left with an income. The earnings of the young husbands in the study were usually so small that it took all they had to provide the daily needs of their families. Even in case of divorce, little or no provision was made.

Mississippi passed a "Children's Aid Bill" in 1928, empowering Boards of Supervisors in each county to set aside a fund not to exceed \$2500 per annum for providing home care and maintenance and support for dependent and needy children. However, reports for 1931 show that few counties had made available such funds. In 1931, 45 families in the State received aid with an average monthly grant of \$11.15 per family, which of course, means that the needs of dependent children were not being met adequately by the counties.⁹ The Social Security Bill which has recently passed Congress will make available additional funds for the care of children of broken families.

The situation of V is quite typical of what often happens to the son who loses his wife. V married and began cropping. His wife died and his mother took the two children. V lives at home and works around as a day laborer for he had to give up farm operation with no woman to help him. Indeed, the widowed son, like his widowed sister, often assumed again the role he had in pre-marital days. Yet neither the son nor the daughter separated from their spouse by death or divorce was a child. In fact, they were an older group than were the group not widowed and divorced. Twenty-one percent of the widowed and divorced sons and daughters were 19-23 years, while 38 percent of the sons and 41 percent of the daughters not widowed and divorced were this age.

The widowed and divorced who again assume the role of children themselves often have children. Returning to the parental home is practically the only choice left for a son left a widower with small children and no means of hiring someone to do the housework and care for the children, or the daughter with a young family and her support gone. Only in this way can the young fathers and mothers satisfy their natural desire to keep their children with them. Many, of course, re-marry. Forty-three sons and daughters in this study had lost their spouse through death or divorce. Fourteen or nearly one-third of these had re-married at the time of the study.

⁹United States Children's Bureau, *Mother's Aid, 1931*, Bulletin 222 (1933) p. 9, 17.

The problem of the future of these young people is more serious for the daughter than for the son. Her occupational career is more dependent upon her husband than is the occupational career of the son upon his wife. Then, too, more sons re-marry, as census figures show more widows than widowers. The problem of the daughter with marital ties broken becomes more serious upon examination of her schooling and occupational history. Sixty percent of the widowed and divorced daughters had had elementary schooling or less, while only 35 percent of the daughters not widowed or divorced had had so little schooling. Only one daughter had had vocational training. Only one had been to college. Only seven had had any gainful employment since leaving school. Yet training and experience is what she must have if she is to find employment.

When a woman loses her husband what can she do except go home to her family if she has had only fifth or seventh grade schooling and no vocational training? Situations like the following were quite typical. W, 27 years old with fifth-grade schooling, is at home with her two children. X, 21 years old with sixth-grade schooling, is at home with her two-year-old child. Further education and training are needed, and especially by the younger daughter. Indeed, there is practically no chance for employment without further training.

It was observed that the situation of the few daughters in the group who had had training and experience was much better than the others. Y, for instance, had taught school two years before she married. After the death of her husband, she returned to her parental home with her two children. Recently she secured regular work. Z, who had had college training, taught school for several years and then married a professional man. When she was left a widow, she secured a place as dietician in a girls' school.

The little schooling received by some of the sons and daughters in the widowed and divorced group was no doubt due to the fact that the majority were sons and daughters of non-owner families, who could less often afford to educate their children than could owner families. As will be recalled, 60 percent of the parental families of the sons and daughters in the eligible group were children of landowners, while 41 percent of the widowed and divorced children were sons and daughters of landowners. One-half of the divorced children came from cropper families. This indicated a need for the development of social case work in rural districts of Mississippi, especially among the families in this tenure group.

Doubtless, some of the sons and daughters drifted into an unfortunate marriage for want of some better way of occupying their time. The recreational needs of the widowed and divorced group had not been met by the parental family to the extent that the needs of the eligible group had been met. At the time these children left school, the parental families of only 23 percent owned an automobile; only 35 percent had a room other than a kitchen not slept in; and only 23 percent subscribed to a daily paper. Nor was the community meeting the needs of these young people adequately. The majority of the group had received very little schooling. Only 4, 3 men and 1 woman, had had vocational training. Only 3 had been members of a 4-H Club, an organization which provides a wholesome as well as a profitable way of using one's leisure. It is a great pity that such a small percentage of this group had not availed themselves of the opportunities of this organization whose advantages are to be had with no or little cash expenditure.

To what extent is the parental family responsible for the support of this group and to what extent is society responsible? Can the farm family of today—a day in which so many of the goods and services needed are to be had only by cash expenditures—assume the entire support or partial support of its grown sons and daughters and their children as it did as in former days?

What is the best policy from the viewpoint of the parental family? From the viewpoint of the handicapped, widowed, or divorced children? These important questions must be solved before the situation of this group can be materially improved.

CHAPTER XI.

'THE DESIRABLE OCCUPATIONAL SITUATION

The data for this study were gathered by personal interviews with 500 cotton farm families, 250 owners and 250 tenants living in Mississippi. The purpose of the study was to present a picture of the occupational situation of the sons and daughters 19 to 34 years of age of these families, to determine what factors were associated with this situation and to suggest, if possible, what can be done to improve it.

What Was the Occupational Situation?

There were in the 500 families included in this study, 799 sons and 768 daughters 19 to 34 years of age, or a total of 1567 individuals. Three-fourths of this group were farming or were dependent at least in part upon the farm for livelihood. Two-thirds were entirely dependent upon the farm. Though these data are not altogether comparable with the data of studies of rural youth of Ohio,¹ North Carolina,² Connecticut,³ and New York,⁴ it seems significant that the percentage of Mississippi farm-reared youth engaged in agricultural pursuits was greater than in the foregoing states.

The majority of the sons engaged in farming were farm operators. However, only 6 percent were landowners. Practically all the husbands of the daughters married to farmers (97 percent) were farm operators; 22 percent were land owners. The vast majority of these farm sons and farm housewives had had no experience in non-agricultural work since leaving school. Two hundred and twelve sons and daughters worked for their parental families without financial agreement, or were in other words, non-cash assistants. Most of these had never been gainfully employed.

Nearly one-half of the sons engaged in non-farm pursuits were unskilled and semi-skilled laborers. One-fourth were managers, clerks and kindred workers. Only 7 percent were independent business men. The distribution of the occupations pursued by the husbands of the daughters married to non-farmers did not differ greatly from sons. Fewer sons-in-law were, however, unskilled and semi-skilled workers and managers, clerks and kindred workers and more were skilled workers and independent business men. The majority of the daughters with non-farm occupations were professional workers, or teachers. Twenty-five or about 40 percent of these, were married women. The husbands of these women were engaged on the whole in occupations similar to their wives.

Sixty-five of the sons were part-time farmers. Farming was the major occupation of three-fourths of these, the minor occupation of the other fourth. Driver and carrier, factory operative and laborer, and laborers in machine and related trades were the occupations most frequently combined with farming. Part-time farmers operated larger farms and were more often landowners than were full-time farmers. Only 44 of the daughters were classified as part-time farming, 26 on the basis of their husbands' part-time farming activities, and 18 on the basis of their own secondary non-farm activity. Most of the latter group were engaged in "New Deal" work as school-lunch work, home visiting, and teaching.

¹Beck and Lively, *op. cit.*, pp. 8-9.

²Anderson and Loomis, *op. cit.*, pp. 17-18.

³Hypes, Rapport and Kennedy, *op. cit.*, pp. 17-19.

⁴Anderson, *op. cit.*, pp. 26-27.

Some of the Factors Responsible for this Occupational Situation

There were a number of factors which were apparently responsible for the occupational situation of these sons and daughters. Many of these factors were closely associated. Among the principal factors were age, formal education, tenure of parents, and place of residence. The preponderance of sons in this study who were farm tenants and laborers and unskilled and semi-skilled workers and of daughters married to men in these occupations can be explained in part by the fact that the study was heavily weighted with the younger group or the 19-23-year-old sons and daughters. A number of the sons and daughters assist on the home farm for a while before getting established. Some of them use unskilled and semi-skilled work as a "stepping-stone" to other kinds of non-farm work.

The limited schooling of the sons and daughters in this study is another explanation for the large proportion farming; for as formal education increased, the percentage engaged in farming decreased. Seventy-eight percent of the sons with 8th grade schooling and under, 62 percent of those with high-school training, 51 percent of the high-school graduates, 49 percent of those with college training were farming. Not one college graduate was farming. The difference was not quite as striking in the case of daughters, undoubtedly due to the fact that the occupational status of the married daughter is usually dependent on that of her husband. However, the more educated daughters were more frequently married to farm owners and managers, clerks and kindred workers; the less educated to tenants and unskilled and semi-skilled laborers.

In the North Carolina study⁵ as well as the New York and Ohio studies⁶ it was found that with increased education more entered non-farming occupations. In other words, formal education is probably one of the principal factors in occupation. This, of course, does not mean that the Mississippi farm is devoid of young men and women with college training (33 sons and daughters with college training devoted full time to farming), but it does mean that the farm group is predominantly a group with limited schooling. There is little work in Mississippi available for those with elementary schooling except on the "lower rungs" of the agricultural ladder. This results in an overcrowding in these "lower rungs" or a supply which is relatively large to the demand for such work. Because the supply is large the price paid for services is low. Thus, "the market is spoiled" for the group who have the training to make a success of farming.

The fact that this study included as many tenant as owner families is without doubt another explanation for the high percentage of children farming. It has been shown that more children of tenant families are in agricultural work; that the farming group comes largely from non-owner families and small land owners; that children of men who farm on a larger scale (as measured in number of work animals and tractors) are in non-agricultural pursuits more often than are the children of small scale farmers. This is contrary to what was found in the Ohio and Connecticut studies; that is, that sons of large scale landowners more often become farmers.⁷ The disagreement may be due to the fact that Mississippi provided the children of small landowners and tenants with fewer opportunities for entering non-farm work than did these other two states.

⁵Anderson and Loomis, *op. cit.*, p. 24.

⁶Loomis, *op. cit.*, p. 37.

Beck and Lively, *op. cit.*, p. 49.

⁷Beck and Lively, *op. cit.*, p. 46.

Hypes, Rapport, and Kennedy, *op. cit.*, p. 46.

Perhaps the principal factor in the large proportion of sons and daughters engaged in farming in this study was the fact that the majority lived on or near the parental farm where opportunities for engaging in any kind of work except farming were limited. Such excessive ruralism is, however, typical of Mississippi as well as some of the other cotton-growing states of the United States.

The Desirable Occupational Situation

A desirable occupational situation for this group of cotton farmers' sons and daughters would be a situation in which each of them had the opportunity and training to engage in the occupation best suited to his ability. There are three methods, it is believed, of bringing about such a situation: (1) public provision of more educational facilities than in the past; (2) greater public supervision of health and control of sanitation; (3) an increase in the general level of incomes.

As has been mentioned, the farm population of Mississippi contains a relatively high proportion of young people. Therefore, its tasks of education are greater than areas largely populated by adults. The low density of population makes this task even greater. As a result, Mississippi is not able to provide her youth the educational facilities provided by many states. The Federal Government should assist in the provision of a better school system in return for the surplus man power furnished. The public schools need to offer a wider range of vocational training for what the general high school or college course has done for a few in the way of making it possible to secure employment it cannot do for many. State employment bureaus are needed to supplement the work of the schools. Such bureaus could give information about available work in and out of the State, training necessary for this work, where such training can be obtained, and how to find a job once the training is secured. Ignorance of the labor market is one of the factors preventing free movement.

The occupational career of the child is associated with his health as well as the health of his family. Sick children cannot secure the training in the occupation for which they are fitted; ill health or a physical defect often interferes with occupational success. Sick parents are usually not able to provide their children with opportunities for securing training to enter the occupations for which they are suited. There is undoubtedly need for greater supervision of the health of rural families living in Mississippi as well as greater control of sanitation. At the present time, the great majority of rural families cannot provide for adequate medical attention for themselves and their children.

In the third place, an increase in the general level of incomes is needed, for if the annual income of the farmers of the state increases absolutely, the incomes of tenants and small landowners will increase and some, at least, of the disadvantages of their children will disappear. Since cotton is the main cash crop, one would look to cotton perhaps as the first means of increasing the level of incomes. In 1934, the year of the study, the gross value of cotton produced per farm reporting cotton in Mississippi was \$272.⁸ That the value was no greater was due to a number of factors. In the first place, a number of the farms were too small for profitable operation. Then cotton was often grown on land yielding no more than 50 or 100 pounds of lint per acre. Indeed, the number of persons engaged in cotton farming could be reduced considerably without reducing to any extent production. Increasing the size of

⁸U. S. Bureau of the Census, *Census of Agriculture, 1935, Mississippi, Statistics by Counties*, p. 5.

Data from the 1934 Bankhead contracts showed 247,996 cotton farm operators in Mississippi with 674,228,943 pounds of lint produced. Valued at 12 cents a pound this would mean that the operators received on an average \$326.24. The group cooperating with the Bankhead program no doubt includes all the "real" cotton farmers of Mississippi.

farms and taking out of cultivation submarginal lands would give to some increased income, and deprive others of an occupation. The submarginal lands taken out of cultivation could be compensated for in part by reclamation of the undeveloped alluvial lands of the Yazoo-Delta Basin and Northeast Mississippi River bottoms.⁹ This would, of course, involve drainage and clearing.

Better methods of cultivation and the introduction of machinery in cotton production will also result in higher returns but to fewer men. Of course, with the development of new uses for cotton and reciprocal trade relations, and with improved business conditions, there will doubtless be an increase in the demand for cotton, which would mean that a larger labor supply would be needed. On the other hand, two competitors, cotton producers in other countries and synthetic fibers may become more powerful. It would, therefore, seem that cotton growing cannot be expected, at least in the near future, to provide a satisfactory living for the vast majority of rural young people of Mississippi, though it can and will provide it for many.

As has been repeatedly stated throughout this report, more industrial opportunities might well be provided the rural young people of Mississippi. Many are farming who are not adapted to it, or who dislike the occupation. At present there is not enough non-farm work in the State to meet the needs of these groups. Increased industrialization would not only provide employment for many of these, but it would result in more markets for those remaining on the farms. Many food crops could be grown for sale which are now not grown because there is no market. More young people could combine non-farm with farm work. Textile mills, furniture factories, paper mills, factories using by-products of cotton, and canning factories would utilize the raw materials produced in the State at the source of their production. This industrial program is, of course, more needed in some counties than in others.¹⁰

There are those who would argue that Mississippi should continue to specialize in farming; that those who wish to pursue other occupations could migrate. However, Mississippi has economic advantages for industrial production such as a large labor supply, raw materials, power, a mild climate, and consequent low cost of living. The possibility of the increased use of machinery in cotton production and the subsequent movement of cultivation to flat lands makes it even more necessary that some provision be made for the use of at least part of the labor supply of the State in industry. Information concerning the labor market outside the State should, of course, be made available to Mississippi youth.

There are other cash crops, in addition to cotton, being produced in the State, such as vegetables, soybeans, milk, forest products. Many more will undoubtedly be developed. The situation of the growers could be improved by better marketing facilities for these products—by the development of stronger cooperatives.¹¹ However, the number of cash crops which can be sold advantageously to distant markets is limited. In fact, counties where a supplementary income is most needed are usually poorly situated as to markets.¹² Indeed, one of the greatest needs is a need for more local markets.

⁹Land may, of course, be submarginal for cultivated crops, but not for grazing.

¹⁰Some one has suggested that these enterprises be controlled by the workers themselves. In this case the government or some other agency would have to do the financing and an experienced manager put in charge. The workers who need the industrial program the most have no capital, nor do they possess experience in the industrial field.

¹¹A committee appointed from Mississippi was sent to Denmark several years ago to study the marketing of agricultural products. This was, of course, a step in the right direction.

¹²The real income of the cotton farmer can be increased, of course, by producing more of his food and feed crops on the home farm. Oftentimes some of the limited cash realized has to be spent for cornmeal, potatoes, hay and the like—products which could easily be produced on the farm with little or no money cost. However, the farm family needs cash as well as food and feed crops in order to maintain a high standard of living. School books, magazines, clothing, labor saving devices, an automobile and the like can be had only by cash expenditures.

One might well ask if industrial employment would provide better living than the farm. Pauper wages and poor working conditions cannot be labeled as progress. However, the advantages of industry may be obtained without such deficiencies and maladjustments. Because of the delay in urbanization of Mississippi, it is possible to develop an urban economy without low wages, child labor, crowded living conditions and poor working conditions. The consideration here is that Mississippi without doubt has a comparative advantage over other areas for production of certain plant and animal products and for localization of specific industries. It is the task of the State to find out what these plant, animal, and industrial products are. In other words, those who determine the policies of the State should work out a plan for raising the level of income of its people which will fit in with the national plan.¹³

The vocational situation of rural young folk is a vital family problem, but its solution lies largely in the hands of the State. Upon the family, however, rests some of the responsibility for training and most of the responsibility for exposing their children to situations where they will have more occupational opportunities. There are latent in every community opportunities for the development of abilities and vocations of sons and daughters. It is the responsibility of the family to seek these out, to improve them or to move elsewhere if need be. It is true, often the individual family can do little to improve a given situation, but individual families working together can, for together they make up the State.

¹³There is in addition another possibility for improving the financial status of the family; namely, a reduction in birth rate.

APPENDIX A

TESTING THE ACCURACY OF THE DATA OBTAINED FROM THE PARENTAL FAMILIES

Just how accurate is the information which families furnish about their grown-up children? An answer to this question is of vital importance to the study. If a large number of families gave the ages of their sons and daughters incorrectly, if they could not recall their occupational histories and similar facts, then this study would be of little value. The problem was to find some means of checking the information obtained from the home—of testing its accuracy.

In the study of Beck and Lively, the information was gathered chiefly from the parents of the individuals in the study.¹ In cases where the children were living in the same township as their parents, they obtained the data from both sources. The data obtained from the parental family were checked against the data obtained from the child. Data obtained from the family and from children living in the same township would undoubtedly agree more closely than from children living elsewhere, as these children would visit home more often. Their parents know more about them. Many of the grown children living outside the township rarely visit home. The sons and daughters far away from home often have more checkered careers—careers more difficult for the family to recall. Sons and daughters living in the same township are usually farmers or farmers' wives. They "speak the same language" as their parents.

It was thought that, for this study—a study in which so many detailed questions were asked about individual sons and daughters, in which so many questions concerned the situation at the time the individual left public school—one must get in touch with a representative sample of sons and daughters to secure information to use as a check upon the information obtained from the parental family. A personal interview with even a representative sample of

Table 122. Number of Farming and Non-farming Sons and Daughters Receiving Questionnaires, Not Returning Questionnaires, and Returning Questionnaires

Occupational group	Receiving questionnaires		Not returning questionnaires		Returning questionnaires ^a	
	Number	Per cent	Number	Per cent	Number	Per cent
Farming sons	265	100.0	119	44.9	146	55.1
Farming daughters	335	100.0	124	37.0	211	63.0
Non-farming sons	155	100.0	86	55.5	69	44.5
Non-farming daughters	173	100.0	90	52.0	83	48.0
Total	928	100.0	418	45.2	509 ^b	54.8

^aTwo of these replies were not usable.

^bThis does not include 3 questionnaires which were returned after all tabulations had been made.

these children was not financially possible. The questionnaire method was, therefore, used.

Fifty-five percent of those receiving questionnaires returned them (Table 122). More farming sons and daughters answered the inquiry than non-farming sons and daughters. This may be due, at least in part, to the nature of the letter accompanying the questionnaire, which stated that we were "trying to find out how our young people who were reared on Mississippi farms have been getting along these last few years. With this information we will be in a position to help boys and girls now being reared on Mississippi farms to get

¹Beck and Lively, *op. cit.*, p. 4.

more out of life." Undoubtedly this letter had more appeal for the farming group.²

There seemed to be several factors responsible for the high percentage of questionnaires filled out and returned. Undoubtedly some thought that returning the questionnaire might mean a job. Several notes attached to the questionnaire indicated this fact. "Sure would appreciate it, if there is any way you could help me obtain work that I could make some extra money. I can sew and do all kinds of fancy work, such as crocheting and embroidering or sewing" "I am very much interested in getting some hospital work in Mississippi, and I'm wondering if you can assist me in securing work along this line" "If you can aid me in any way to provide a job I sure would be glad as farming is somewhat on the low down drag" "I will appreciate all the help I can get in any way as we are just trying to pay for a small farm of 40 acres. It sure is hard times trying to pay debts" "I would appreciate it very much if you could give me some kind of work to do."

Others thought of getting information which would better their own occupational situation. "Would appreciate any information to better myself and family. The last few years have been very hard. I need a lot of information on how to better myself, and how to manage thru times like these" "I am now and have been for past 4 years a waiter at The chance for advancement and outlook for the future in this calling is not particularly bright. Could you offer me any advice or suggestions which would help me to better myself in any way?"

A few were lonesome and wanted to enlist a correspondent. "If interested in me or my work, I'll appreciate hearing from you again" "I enjoy farming best of all. I would take to correspondence with you. You write and I do my part. Your true friend"

Many were glad to help as they thought the study would be of value. "The work you are doing should be a help to a great state—although a badly undeveloped one in comparison with other states" I appreciate the fact that there is an interest being taken in farm boys and girls. We farm people appreciate this work" "Glad to give my help in relieving the outcome of them other people" "Hoping this will help you in some way give the country children a better chance to make some one important out of themselves" "Am so glad you are taking an interest in farm boys and girls because they have been left out long enough and I wish you success."

The fact that each child's family was visited before the questionnaires were sent out was undoubtedly a factor in the high percentage of returns. The majority of replies were received several weeks after they had been mailed. This seemed to indicate that the family had been consulted. A number replied two or three months after they received the questionnaire; a few four months after they had received it.

A high percentage of returns from the questionnaires sent out was, of course, not as important in this study as getting a representative sample to reply. Unless those who returned the questionnaires were typical, the records would not be of great value as a check on the accuracy of the data obtained from the family. If the better educated children—the children from the more prosperous homes—were the only ones to respond, the discrepancy in the replies of the family and child would be low. Then the data would appear to be more accurate than they actually were.

Two tests of the typicalness of the sons and daughters who returned the questionnaires have been set up. The first gives the number and percent of

²Of the 975 questionnaires sent out, 47 were returned unopened, indicating that inadequate or incorrect addresses had been obtained from the family.

sons and daughters in varying education groups to whom the questionnaires were sent, and number returning usable replies (Table 123). The percentage of those to whom questionnaires were sent and of those who returned the replies was almost exactly the same. The group who returned the questionnaires in this study was, therefore, not the better educated group.

The other test of the typicalness of the group returning the questionnaires is the number of sons and daughters of owners and non-owners who were mailed questionnaires and who returned the questionnaires (Table 124). This test shows also the group returning the questionnaires to be typical. Sons and daughters of non-owners returned the questionnaires as often as sons and daughters of owners.

Rather than understating the inaccuracies of the data obtained from the parental family, the material on the questionnaires, it would seem, overstated them. In the first place, the two groups about whom the most accurate data were obtained were not sent a questionnaire—children living at home and children present at the interview. The children living at home were, for the most part, the younger children about whom the family could give more accurate information. The information obtained about children present at the interview was the combined judgment of the family and of the child concerned, probably the most accurate information obtained in the study.

In the second place, there is evidence that information obtained from the family was more accurate in some cases than that obtained from the child.

Table 123. Education^a of Sons and Daughters to Whom Questionnaires were Mailed and by Whom Usable Replies were Returned

Education groups	Mailed questionnaires		Returning usable replies	
	Number	Per cent	Number	Per cent
No schooling	1	*	1	*
Eighth grade and under	412	42	209	41
High-school training	370	38	189	38
High-school graduate	133	14	76	15
College training	37	4	21	4
College graduate	22	2	11	2
Total	975	100	507	100

^aAs given by the family.

*Less than .5 per cent.

For instance, in one family visited, the mother talked at length of her un-realized ambition—that of having a child graduate from high school. Her oldest, a son, had to stop school to help on the farm; the next, a daughter, quit school to marry; her third, a daughter, failed to make her grade, became discouraged and quit. The questionnaire from her oldest stated that he had finished high school. Just why this apparent misstatement was made is, of course, not known.

The question may well be asked, "What if the replies of the family and the child do agree, does it necessarily follow that the reply is correct?" Perhaps the children consulted the parental family in filling out the questionnaires, and the agreement is intentional. Undoubtedly, many of the children did consult their parents before returning the questionnaires. However, it

Table 124. Tenancy of the Parental Family^a of the Sons and Daughters to Whom Questionnaires were Mailed and by Whom Usable Replies were Returned

Tenancy of parental family	Mailed questionnaires		Returning usable replies	
	Number	Per cent	Number	Per cent
Owner	579	60	295	58
Non-owner	396	40	212	42
Total	975	100	507	100

^aAt time the son or daughter left school.

seems unlikely that whatever agreement found in the replies was due to any conscious effort or act of memory on the part of the child or family. In the first place, the family was not told that similar information would be obtained from the child. In the second place, it seems improbable that with the numerous questions asked and with the interval between the visit of the field agent and the arrival of the questionnaire, the family would remember just what information they had given.

Is there any except such surmised evidence that when the family's and child's replies agree, the answer is generally correct? Records obtained of the education (grade when left school) of 86 grown children having no more than

Table 125. Questions Asked About Sons and Daughters of the Family by the Schedule Method, and of the Son and Daughter by the Questionnaire Method Classified by Number and Percentage of Agreement and Disagreement in Replies

Questions	Agreement		Disagreement		Unanswered		Total ^a	
	Num- ber	Per cent	Num- ber	Per cent	Num- ber	Per cent	Num- ber	Per cent
At time of leaving school:								
Tenancy of parental family.....	477	94	24	5	6	1	507	100
Type of parental family.....	494	98	12	2	1	*	507	100
Parental farm mortgaged.....	242	82	35	12	18	6	295	100
Slept in all but kitchen.....	421	83	82	16	4	1	507	100
Parental family own auto.....	452	90	50	9	5	1	507	100
Parental family take daily paper.....	421	83	84	16	2	1	507	100
Approximate distance to nearest town of 2500 inhabitants.....	462	91	37	7	8	2	507	100
Before leaving school:								
In town of 2500 inhabitants.....	462	91	41	8	4	1	507	100
Spent night in town of 2500 inhabitants.....	411	81	92	18	4	1	507	100
Member of 4-H Club.....	436	86	67	13	4	1	507	100
Education.....	306	60	200	40	1	*	507	100
Education group.....	461	91	45	9	1	*	507	100
Present age.....	373	73	130	26	4	1	507	100
Age group.....	465	92	38	7	4	1	507	100
Present age (taken from Family Bible).....	91	81	20	18	1	1	112	100
Age group (taken from Family Bible).....	107	95	4	4	1	1	112	100
Attended college.....	31	94	2	6	—	—	33	100
Name of College.....	30	91	1	3	2	6	33	100
Years in college.....	24	73	9	27	—	—	33	100
Who financed college education.....	22	67	8	24	3	9	33	100
How earned way.....	21	81	1	4	4	15	26	100
Major subject.....	14	47	4	13	12	40	30	100
Present main occupation.....	482	95	21	4	4	1	507	100
Present supplementary or secondary occupation.....	423	83	81	16	3	1	507	100
Spatial mobility since leaving school.....	186	82	38	17	3	1	227	100
Number mules worked by farming sons.....	100	68	14	10	32	22	146	100
If owner, farm mortgaged.....	11	61	4	22	3	17	18	100
Occupation or tenure of hus- bands of married daughters.....	239	89	39	11	—	—	278	100
Daughters married to farmers:								
Work in field.....	165	79	42	20	2	1	209	100
Work garden, dairying, etc... House work only.....	199	95	5	2.5	5	2.5	209	100
	205	98	2	1	2	1	209	100

^aSome of these questions did not apply or were not asked certain members of this group.

*Less than one per cent.

Table 126. The Agreement and Disagreement of Replies to the Question Concerning Occupational History, Obtained from the Family by the Schedule Method, and from the Child by the Questionnaire Method

Agreement of replies to the question concerning occupational history	Number	Per cent
Agreement	421	83
Disagreement	84	17
Family gave fewer occupations.....	51	10
1 less	37	7
2 less	11	2
3 or more less.....	3	1
Child gave fewer occupations.....	28	6
1 less	26	6
2 less	1	*
3 or more less.....	1	*
Different occupation mentioned by each.....	5	1
Unanswered	2	*
Total	507	100

*Less than .5 percent.

public school education from three sources, the school, the family, and the child, is the one bit of actual evidence we have. Records obtained from all three agreed in 50 cases; in 14 cases records from the child and school only agreed; in 8 cases records from the family and school only agreed; in 3 cases records from the family and child only agreed; and in 11 cases records from all three sources disagreed. It would, therefore, seem that usually the answer is correct when the replies of the child and the family are the same.

A sufficient number of questionnaires (507) were returned by the sons and daughters to use their replies as a test of the accuracy of the material obtained from the parental family. All the questions included in the questionnaire are consequently listed (Tables 125 and 126), and the number of cases in which the replies of family and child agreed and disagreed noted.

The replies of the sons and daughters and the family agreed closely on tenancy of parental family (94 percent), whether parental family owned an auto (90 percent), type of parental family (98 percent), and the approximate distance to the nearest town at time of leaving school (91 percent).³ However, the replies of two groups did not agree very closely on whether the parental farm was mortgaged (82 percent). In 26 of the 35 cases of disagreement in the replies of the family and the children as to whether the parental farm was mortgaged at the time of leaving school, the family stated that the farm was mortgaged, the child that it was not mortgaged. At 12 of these interviews the father was present. It would seem that at least in these cases the family's reply was the correct reply.

In the questionnaires sent out to the sons and daughters in the preliminary study, the question concerning the dining or living room was asked as follows: "At time you left public school, did your family have a dining or living room?" The wording of this question was changed on the questionnaire sent out in the study to: "At the time you left public school, did your family ordinarily use every room they had except the kitchen to sleep in?" It was thought that by changing the wording, greater accuracy could be obtained. However, this was not the case. The question as it was reworded was a "catch question" for some, evidenced by the fact that several inserted, "Yes, every room except the dining room." In 70 of the 82 disagreements, the

³Some children gave the name of a nearby village in which case the distance from a town had to be worked out. It is believed that error in estimating these distances may be as great as three miles in some cases. For this reason, agreement concerning approximate distance (within 3 miles) only is listed. Disagreement on actual distances was 55 percent. However, in some cases the disagreement was only one-fourth of a mile.

family answered "No" to this question; the child "Yes." Evidently many children understood the question to mean, "Did you have a parlor?"

The disagreement on whether the parental family took a daily paper at the time of leaving school was also high (16 percent). Many of the families took a daily paper now and then; that is, when some one started a paper route through the neighborhood or when a bargain offer was made by a daily paper, the families temporarily subscribed. These families found it quite difficult to remember whether they were taking a daily paper when Johnnie or Mary quit school. In 58 of the 83 cases of disagreement, the family said they were not taking a daily paper, the child said they were. It is thought that perhaps sons and daughters in filling out the blanks did not notice the phrase, "at the time of leaving school."

The agreement of family and children as to whether the child was a member of a 4-H Club before he left public school was another fact which some of the families could not readily recall (86 percent agreement). Of course, there were all degrees of club membership. Many of the families replied to the question concerning club membership of their sons and daughters, "Oh, he or she joined, but never did do anything. I wouldn't count it." This is probably one reason why disagreements were more often due to the fact that the family stated the child was never a 4-H Club member, the child stated he was.

It seems probable that the replies obtained from the sons and daughters on visits to town and membership in a 4-H Club before leaving school are more accurate than from the family, for many families and especially those in which there were a number of children had difficulty in recalling the facts. It was observed that in the interviews where the individual concerned was present, the mother would always say, "Answer that question. You know more about it than I do."

There was a discrepancy of 40 percent in the replies of the family and of the sons and daughters concerning education. This was not due to any tendency on the part of the family to overstate or understate the education of the child, but to the fact that families did not always remember in just what grade their children were when they quit school. Fortunately, the important thing for this study is not to get the exact grade the child was in when he left school, but to get the correct education group in which he belongs. The grade might be given incorrectly, yet not affect the education group in which the child is placed. The fact that there was a disagreement of only 9 percent in the education group bears out this statement.

The main problem in getting ages was not that the people did not like to divulge this information, but that a few actually did not know how old members of their family were. Stating the present ages of the members of their family was a great task for many. For instance, in one home visited, the mother was found in bed, a semi-invalid. When asked about the ages of her children, she frankly replied, "I don't know their ages." She was asked if she had a family Bible with ages recorded. "No, I never set them down, but," she added, "my children know their own ages." One of the older daughters was called from her home nearby, and a son from the field, and with their help the age of each member of the family was recorded.

Some of the people interviewed assumed that it was not necessary to give ages exactly.⁴ In fact, several of the mothers interviewed said, "All you want is an idea of how old they are, isn't it?" They were, of course, told that we wanted to get the ages as accurately as possible. Others would say, after giving the record of their first child, "Oh, just 'put me down one every two years until you get to seven and that will be about right."

⁴The investigator wondered if this assumption was not based on their experience with census enumerators.

It is interesting to note that the disagreement in the present age obtained from the family and from the children was about 26 percent. Cases in which the date of birth given by the son or daughter agreed with that given by the family were counted as agreeing, even though the age given by the son and the daughter did not agree. There were 45 cases in which the age and the date of birth given by the child did not agree. One son, for instance, gave his date of birth as December, 1909, and his present age as 25 years. He was, however, at that time, only 24 years of age. This tendency to give next age (not necessarily nearest age) was evident in interviewing the families, as well as in the replies of the sons and daughters. Of course, in interviewing the families, one could stress the fact that present age was wanted. It would seem from this, that one must in all cases get date of birth as well as age, if for no other purpose than to use as a check.

The failure of sons and daughters to state their ages correctly was not always due to confusion of next and present age. It was due occasionally, as in the case of their parental family, to not knowing their ages. In one family visited, a married daughter who happened to be at home, gave her age as 27 years. She was astounded to find that, figuring from the Family Bible, she was 29 years old. "Why, I've been thinking that I was younger all the time," she said. A few of the sons and daughters did not have the ability, or were not willing to take the time, to figure their ages correctly. One daughter thus reported that she was 15 years old, born October 21, 1913.

As in the case of the information obtained concerning education, the important thing for this study was to place the individual in the age group to which he belonged. Thus the parental family might state the child's age as 21 years, the child his own age as 20 years. In either case, he would be placed in the 19-23-year age group. While there was a disagreement in the replies of family and child as to present age in 26 percent of the cases, there was a disagreement as to age group in only 7 percent of the cases.

Were disagreements in the ages of the children less when the family supplied the information from the Family Bible? Yes, they were 8 percent less.⁵ However, unfortunately, many of the families did not have the ages of members of the family recorded in the Bible. Some who had recorded the ages, could not find the Bible at the time of the interview. Others had loaned their Bible. A few insisted that they knew the ages of their children and there was no need for consulting the Bible.

Ages recorded in the Family Bible are not necessarily infallible. Births were not always recorded when they took place. Indeed, many of the Family Bibles were not bought until the prosperous years of 1924 and 1925 when Bible salesmen invaded the rural districts of Mississippi. However, ages recorded in the Family Bible were likely to be more carefully thought out, even though entered only 8 or 10 years ago, than ages given at an interview. It is possible that in a few cases ages taken by the schedule method might be more accurate than ages taken from the Family Bible. One family visited had the birthday of all members of the family recorded on a large decorated placard. This had been framed and hung on the wall of a front bedroom. Yet the birthdays of two sons were recorded as six months apart.

How close was the agreement of the two groups concerning college education? The agreement on whether the son or daughter attended college and the name of the college or colleges attended was high (94 percent and 91 percent, respectively). However, the agreement as to the number of years in

⁵This seems to indicate that the information received from the child was more accurate than that from the family. However, families keeping a record of family ages in Bibles are on the whole superior families. Then, too, children from homes in which ages have been recorded may be more age conscious.

college and who financed the college education was not so high (73 percent and 67 percent). The family seemed to have much the same difficulty in stating the number of years in college as they had in stating the number of years in public school. However, as in the case of public school education, placing the individual in the correct group was all that was desired. There were only two education groups for college students: those who had attended college, and those who had finished college. There were no disagreements in the replies of the family and the child as to whether the person concerned had finished college.

The high discrepancy in the replies as to who financed college education (24 percent) was largely due to the family saying that they had paid part of the child's college expenses, while the child said he made all his way. In some cases, parents doubtless gave their children part of the crop toward their college expenses and the child thought it his because he had helped to work it. Then, too, when one works a large part of one's way through college, the effort is so great that in after years, perhaps, one remembers only those hard earned dollars spent.

How the child earned his way or part of his way in college is a detail which the family is likely to forget. However, the agreement (81 percent) is much higher than on the question of who financed the college education. The child's major subject in college was a fact that 40 percent of the families could not give.⁶

Agreement in the replies of the family and son or daughter concerning present main occupation was high (95 percent). Most of the few disagreements were not actual disagreements, but were classified as such, for information obtained concerning occupation was too indefinite to classify. For instance, the parents of one son gave his present occupation as truck driver. He gave it as "public work". This was counted as a disagreement.

Disagreement in the replies of the family and of the child as to supplementary or secondary occupations (16 percent), was as would be expected, much higher than for main occupations. The two groups where disagreements were found most frequently were farming sons who, the family stated, had had CWA work and who did not give this information themselves, and farm homemakers who, the family stated, supplemented the family income by producing food for sale and did not give this information themselves.⁷

The question concerning the spatial mobility was another question in which the percentage of disagreement was fairly high (17 percent). It is evident that a few misunderstood the question concerning the spatial mobility, although its wording seemed clear: "Since the time I was in public school I have always worked on the same farm or in the same position, in the same community or town, in same county, in same state, other (check what you have done)." Some of the sons and daughters checked every item. Information on the spatial mobility of women whose main occupation was that of housewife was not secured as their spatial mobility was entirely dependent on that of their husband.

Twenty-two percent of the farming sons failed to answer the question, "Number of mules worked." It is thought that the preceding question confused them. The preceding question was, "Do you own your work animals? If not, how secured?" A number undoubtedly thought that "number of mules

⁶In most cases, the child had had only one or two years in college and had really done little special work. Therefore, in the tabulation in Chapter IV, giving the major subject in college, the list is limited to those who had more than 2 years in college.

⁷In the preliminary study in which the family was not questioned closely as to gainful employment of daughters married to farmers, the family, less often than the daughter, stated that the daughter earned money from sale of farm products.

worked" applied only to farmers owning work animals, since it followed that question.

The replies of the daughters married to farmers as to whether they did dairying, poultry work or gardening, and housework agreed closely with the information given by their families (95 percent and 98 percent, respectively). Naturally, the agreement would be high, for these two types of work are done by the majority of farm homemakers. However, agreement between the replies of daughters and their families as to whether they worked in the field was not so high (79 percent). There were as many families, however, who said their daughters worked in the field when the daughter said she did not as there were families who said their daughters did not work in the field when the daughter said she did. This seems to indicate that whatever discrepancy was found was not the result of undue influence of the investigator; that is, that families were not made to feel that working in the field or not working in the field was the thing to do.

The majority of daughters do at times work in the field. In many cases the family answered "some" to this question. This, of course, was counted as working in the field. Daughters who ordinarily do field work may discontinue field work at certain times. Daughters who ordinarily do not work in the field may do so if their husbands get behind with their work. To get a better check on this question, one should state it differently.^a

Disagreements in the replies of the family and the child as to the occupational history of the individual concerned were fairly high (17 percent). More of the discrepancies were due to the family failing to name an occupation which the child named than to any other cause (Table 126). No attempt, of course, was made to secure the various positions held by the sons and daughters. A son might, for instance, state his occupational history as driving a grocery truck, farming; or delivering coal, and farming. If his family gave his record as farming and truck driving, then the records of the two were counted as agreeing. No attempt was made to trace the child's shiftings from one to another type of occupation, except to get the main types of occupations followed since he or she had left school.

It is important to know of the agreements or disagreements in the replies of family and child, not only as a whole, but also in which groups the greatest agreements or disagreements were found; farming sons? farming daughters? non-farming sons? non-farming daughters? children of owners? children of non-owners? It was also thought important to know from what members of the family the greatest agreement in the replies of the child could be obtained.

The replies of non-farm children as to visits to town, education, age and supplementary or secondary occupation agreed more closely with the information given by their families, whereas the replies of the farming children as to membership in the 4-H Club and their occupational history agreed more closely with the information given by their families. Probably non-farm children visited in towns of 2500 inhabitants frequently enough, and farming children participated in 4-H Club work zealously enough for there to be less cause for either party failing to recall these facts. The fact that there was a closer agreement in the replies of the family and the non-farming children as to age and education is at least in part due to the better education of non-farming children and their parents. Non-farm children seldom had a supplementary or secondary occupation. The occupational history of farming children was less varied. Many had done nothing except farm. Consequently, there was more

^aIn the preliminary study there were only a few discrepancies in the replies of daughters and families on this question. However, in the preliminary study there were only a few farming daughters. This seems to indicate that a preliminary testing of data with only a few cases is inadequate.

agreement between the child and family in these groups. The less there is to recall, the less often there is a disagreement.

The difference in the disagreement in the replies of the family and the child was greater in the case of the two occupational groups than in the case of sons and of daughters. On only one question, that concerning occupational history, was the agreement in the replies of the daughters and the parental family noticeably and consistently different from that of sons and the parental family. In this case the agreement was greater, for the occupational careers of the daughters were not as varied as that of the sons.

The agreement was greater in the majority of questions in the replies of land owning families and their children. This may be partly due to the fact that owner parents and children in this study had more education than did non-owner parents and children. It may also be due to the fact that non-owner families move more frequently and one or the other party is more likely to forget just where they were living when the individual left school. The agreement, however, was greater in a few of the questions in the replies of non-owners and their children than in owners and their children. Disagreement as to 4-H Club membership was 8 percent greater among parents and children of owner families than of non-owner families. Sons and daughters of owner families participate in clubs to a much greater extent than do sons and daughters of non-owners. There was, therefore, more opportunity for the family to confuse the 4-H Club with other clubs to which their children had belonged.

Replies of the child and the family when different members were interviewed did not show any striking difference as to agreement. The percentage of agreement was, however, somewhat greater when the mother was present at the interview. Fathers are not as likely as mothers to know the ages of their children, nor other little intimate details about them.

APPENDIX B

QUESTIONNAIRE USED IN THE PRELIMINARY STUDY

Note: Please answer every question on this blank as accurately as possible. Put blank in envelope and mail. **Thank you.**

Your name

1. At the time you left public school, was your father a land owner.....or renter..... (check what he was)
2. At the time you left public school did your family have a living room or dining room.....any musical instruments.....an auto.....(check what they had). Did your family take a farm paper at this time..... If so, what.....
3. At the time you left public school what was the nearest town of 2500 inhabitants..... How far did you live from it..... miles.
4. Did you earn money before leaving school that you could spend as you pleased?..... If so, how did you earn it?..... What did you do with it?.....
5. Before leaving school did you ever spend a night in a town of 2500 inhabitants?..... If so, what..... What was the largest town you were ever in before leaving public school?.....
6. Were you ever a member of a 4-H Club?..... If so, did you send an exhibit to a county fair.....keep a record book.....attend meetings regularly.....(check what you did). Was there a 4-H Club in your community?.....
7. In what grade were you when you left public school.....

8. Present age.....
9. How old were you when you left public school..... Year.....
10. *What have been your **main** occupations since leaving school?

Type of work

When? (Dates as near as
you can give them)

*If farming, state whether owner or renter.

Additional questions added to questionnaires going to farming sons.

11. Are you a farm hand, share renter, cash renter, land owner, manager, (check what you are). Do you own your work animals.....
number of mules worked.....
12. If an owner, do you owe any money on your farm.....
13. Do you make any money other than by farming..... If so, how.....

Additional questions added to questionnaires going to daughters married to farmers.

11. Is husband a farm hand, share renter, cash renter, owner, manager, (check what he is). Does he own his work animals.....
12. Do you earn money of your own..... If so, how.....
13. Do you work in the field, do outdoor farm work as poultry work, garden work, do housework (check what you do).

Additional questions added to questionnaires going to non-farming sons.

11. Do you make money in any other way than method given above.....
If so, how.....

Additional questions added to questionnaires going to daughters married to non-farming sons.

11. In what type of work is your husband.....
12. Do you make any money of your own..... If so, how.....

APPENDIX C

QUESTIONNAIRES USED IN THE STUDY

A. Form sent to those not having finished public school.

Note: Please answer **every** question on this blank as accurately as possible.
Put blank in envelope provided and mail. **Thank you.**

1. Your name
2. At the time you left school, was your father a land owner.....
or renter..... (check what he was).
3. At the time you left school, were your father and mother living.....
one or both parents dead..... had step-parents..... (check correct item).
4. Answer this if your parents were land owners: At the time you left
public school was your parents' farm mortgaged?.....
5. At the time you left public school, did your family ordinarily use every
room they had except the kitchen to sleep in..... Did they have an
auto..... Did they take a daily paper..... If so, what.....

6. At the time you left public school what was the nearest town.....
How far did you live from it?.....miles.
7. Before leaving school what was the largest town you were ever in.....
.....Largest town you ever spent the night in.....
8. Were you ever a member of a 4-H Club.....
9. In what grade were you when you left school.....
10. Present age.....Date of birth.....
11. What have been your main occupations since leaving school?*

What

Where

*If after leaving public school you stayed at home for a while and assisted on the farm or in the home, note this fact. Give your occupational history since finishing school in detail, including all main occupations. If occupation farming, state whether owner or renter.

B. Form sent to those having finished public school.

Note: Please answer **every** question on this blank as accurately as possible.
Put blank in envelope provided and mail. **Thank you.**

1. Your name
2. When you finished public school, was your father a land owner.....
or renter.....(check what he was).
3. At the time you finished public school, were your father and mother living.....
one or both parents dead.....had step-parents.....(check correct item).
4. Answer this if your parents were land owners: At the time you finished public school, was your parents' farm mortgaged.....
5. At the time you finished public school did your family ordinarily use every room except the kitchen to sleep in.....did they have an auto.....
Did they take a daily paper.....If so, what.....
6. At the time you finished public school what was the nearest town of 2500 inhabitants.....
How far did you live from it.....miles.
7. Before finishing school, what was the largest town ever spent the night in.....
8. Were you ever a member of a 4-H Club.....
9. Are you a high school graduate.....
10. Did you attend college.....What college.....How long.....
11. Who financed your college education.....If earned way, or part of way, how did you do it.....
12. Major subject at college.....
13. Present age.....Date of birth.....
14. What have been your main occupations since finishing school?*

What

Where

*If after finishing school, you stayed at home for a while and assisted on the farm, or in the house, note this fact. Give your occupational history since finishing school in detail, including all main occupations. If occupation is farming, state whether owner or renter.

Additional questions to questionnaires going to farming sons.

- a. Are you a farm hand_____ share renter_____ cash renter_____
manager_____ owner_____ (check what you are). Do you own your
work animals_____ If not, how secured_____
Number of mules worked_____
- b. If an owner, do you owe any money on your farm_____
- c. Do you earn any money other than by farming_____
- If so, how_____
- d. Since the time I left or finished public school I have always lived on the
same farm_____ in the same community_____ in the same county_____
in the same state_____ all other_____ (check what you have done)

Additional questions added to questionnaires going to daughters married to farmers.

- a. Is husband a farm hand_____ share renter_____ cash renter_____
manager_____ owner_____ (check what he is). Does he own his
own work animals_____ If not, how secured_____
b. Do you earn any money of your own_____ If so, how_____
- c. Do you work in field_____ do outdoor farm work as poultry, gardening
_____ housework_____ (check what you do).

Additional questions added to questionnaires going to non-farming sons.

- a. Since the time I was in public school, I have always worked in same
position_____ lived in same town_____ in same county_____ in same
state_____ all other_____.
- b. Do you earn money in any other way than method given above_____
- If so, how_____

Additional questions added to questionnaires going to daughters married to non-farmers.

- a. In what type of work is your husband_____
- b. Do you earn any money of your own_____ If so, how_____

Additional questions added to questionnaires going to daughters (unmarried) with non-farming occupations.

- a. Since the time I was in public school, I have always worked in same po-
sition_____ lived in same county_____ in same state_____ all other
_____ (check what you have done).
- b. Do you earn money in any other way than method given above_____
- If so, how_____

Note: The preliminary study had shown the desirability of using two types of questionnaires, one for those whose parents said they had finished public school, another for those whose parents said they did not finish public school. The word "leave" seemed to be confusing to those who had finished school.

APPENDIX D

Preliminary Schedule

**MISSISSIPPI STATE COLLEGE, AGRICULTURAL
EXPERIMENT STATION**

Department of Home Economics

Name of family_____ Date_____

1. Location of the family:

County_____ Post Office_____

How long has family lived on same farm.....If not always, give places of residence, counties, approximate dates, and distances from nearest town of 2500 inhabitants during time children included in the study were in school.

[illegible]

Were father _____ and mother _____ reared on farm?

Members of Family*	Date of Birth	Age	Re- marks**	Grade in School Finished	Occu- pation	Place of Residence

**In case of death, give date of death. In case of remarriage of father or mother, give date.

Do you have a living or dining room musical instruments.....
an auto.....

Do you subscribe to a farm paper _____ If so, what _____

If not always provided with these, give date of first acquiring, or if formerly provided but not now, give date of discontinuing _____

Item	Individual Record	Individual Record	Individual Record
1. Full name of individual	_____	_____	_____
2. Post office address	_____	_____	_____
3. Inherited land or capital	_____	_____	_____
4. 4-H Club record:			
a. Member			
(1) Active	_____	_____	_____
(2) Passive	_____	_____	_____

- b. Non-member
 (1) No club
 (2) Not interested
5. Earned money before leaving school:
 a. How
 b. Where
 (1) At Home
 (2) Not at home address
 (3) Both
 c. What did he do with it:
 (1) School
 (2) Clothing
 (3) Spending money
 (4) Savings
 (5) Parents
6. Experience in town before leaving school:
 a. Visited overnight
 (1) Town less than 2500
 (2) Town more than 2500
 b. Not in town more than 2500
7. If married:
 a. Daughter or son of farmer
 b. Type of family
8. Supplementary occupation
9. Education:
 a. Grade in school finished
 b. Age of leaving school
 c. Elementary school attended
 d. Dormitory student
 e. College attended
 f. Major subject
 g. Method of financing college education
10. Item

Occupational history Occupation or tenure and dates			

11. Always lived on same farm, in same community, county, state, other

Specific information regarding special groups:

a. Farming sons

Item	Individual Record	Individual Record	Individual Record
1. Name of individual	_____	_____	_____
2. Tenure	_____	_____	_____
3. Farm mortgaged	_____	_____	_____
4. Rent kin's land	_____	_____	_____
5. No. of mules worked	_____	_____	_____
6. Financial arrangement with sons at home	_____	_____	_____
7. Occupational status in family of sons at home	_____	_____	_____

b. Farming daughters:

Item

1. Name of individual	_____	_____	_____
Unmarried			
2. Financial arrangement with family	_____	_____	_____
3. Occupational status in family	_____	_____	_____
Married			
4. Tenure of husband	_____	_____	_____
5. Work in:			
a. Field	_____	_____	_____
b. Gardening, poultry, dairying	_____	_____	_____
c. Housework only	_____	_____	_____

c. Non-farming children:

Item

1. Name of individual	_____	_____	_____
2. Occupation	_____	_____	_____
3. Occupation of husband	_____	_____	_____

APPENDIX E

Schedule

MISSISSIPPI STATE COLLEGE, AGRICULTURAL EXPERIMENT STATION

Department of Home Economics

Family No. _____ Persons interviewed _____ Date _____

1. Name of head of family _____

2. Information regarding family: _____

Item	Individual Record	Individual Record	Individual Record
6. Transportation furnished to high school	-----	-----	-----
7. Either parents invalid or incapacitated for work	-----	-----	-----
8. If owner:			
(a) Farm mortgaged	-----	-----	-----
(b) Number acres owned	-----	-----	-----
9. Number mules worked	-----	-----	-----
10. Number tractors	-----	-----	-----
11. Number tenant families assisting in making crop	-----	-----	-----
12. Every room except kitchen ordinarily used to sleep in	-----	-----	-----
13. Own an automobile	-----	-----	-----
14. Take a daily paper	-----	-----	-----
15. If so, what	-----	-----	-----
e. If married:			
1. Daughter or son of farmer	-----	-----	-----
2. Type of family	-----	-----	-----
f. Education			
1. Grade when left school	-----	-----	-----
2. Age of leaving school	-----	-----	-----
3. Last grammar school attended	-----	-----	-----
4. Last high school attended	-----	-----	-----
5. Dormitory student	-----	-----	-----
6. Special training	-----	-----	-----
7. College attended	-----	-----	-----
8. How long	-----	-----	-----
9. Method of financing college education	-----	-----	-----
10. If worked way through college, how	-----	-----	-----
11. Major subjects in college	-----	-----	-----
12. Occupational or tenure history	-----	-----	-----
-----	-----	-----	-----
-----	-----	-----	-----
-----	-----	-----	-----
-----	-----	-----	-----
13. Initial place of residence after leaving public school	-----	-----	-----
14. Always worked on same farm or in same position, in same community or town, in same county, state and other	-----	-----	-----

Item	Individual Record	Individual Record	Individual Record
g. Specific information regarding special groups:			
a. Farming sons:			
1. Name of individual	_____	_____	_____
2. Present tenure*	_____	_____	_____
3. If owner, farm free of debt	_____	_____	_____
4. If owner, how land obtained	_____	_____	_____
5. Rent kin's land	_____	_____	_____
6. Number of mules worked	_____	_____	_____
7. Financial arrangement with sons at home	_____	_____	_____
8. Occupational status in family of sons at home	_____	_____	_____
9. Supplementary occupations:			
(a) Timber	_____	_____	_____
(b) School truck	_____	_____	_____
(c) Carpenter	_____	_____	_____
(d) Road Work	_____	_____	_____
(e) Other	_____	_____	_____
Is it regular or irregular	_____	_____	_____
b. Farming daughters:			
1. Name of individual (unmarried)	_____	_____	_____
2. Financial arrangement with family	_____	_____	_____
3. Occupational status in family	_____	_____	_____
4. Tenure of husband (married)	_____	_____	_____
5. Regular supplementary occupation	_____	_____	_____
6. Work in:			
(a) Field	_____	_____	_____
(b) Garden, poultry, dairy	_____	_____	_____
(c) Housework	_____	_____	_____
7. Gainful employment:			
(a) Sewing	_____	_____	_____
(b) Boarders	_____	_____	_____
(c) Poultry	_____	_____	_____
(d) Flowers	_____	_____	_____
(e) Vegetables	_____	_____	_____
(f) Other	_____	_____	_____
Is it regular or irregular	_____	_____	_____

*Renters own workstock, croppers do not own workstock.

c. Non-farming sons:

- | | | | |
|-----------------------------|-------|-------|-------|
| 1. Name of individual | ----- | ----- | ----- |
| 2. Main occupation | ----- | ----- | ----- |
| 3. Supplementary occupation | ----- | ----- | ----- |
| 4. Regular | ----- | ----- | ----- |

d. Non-farming daughters:

- | | | | |
|---|-------|-------|-------|
| 1. Name of individual | ----- | ----- | ----- |
| 2. Main occupation | ----- | ----- | ----- |
| 3. Supplementary occupation | ----- | ----- | ----- |
| Regular | ----- | ----- | ----- |
| 4. Occupation of husband | ----- | ----- | ----- |
| 5. Husband a regular supplementary occupation | ----- | ----- | ----- |

Remarks: -----

APPENDIX F

CLASSIFICATION OF NON-FARMING OCCUPATIONS

(Character of Work—Classification No. I)

One of the bases used for the classification of occupations of sons and daughters engaged in non-farm occupations was that of the "character of work" involved. The occupations were classed in twelve groups:

(1) **Clerical service:** Bookkeeper; cashier; mail clerk; shipping clerk; bank teller; bank cashier; stenographer; station agent (small town); filing clerk; record keeper; secretary of Chamber of Commerce; postmaster (in very small town); enumerator; clerk not in stores; collector.

(2) **Common labor:** Assistants or helpers in laying gas, water and power lines, concrete roads, steel rails; laborers in oil fields, sandpits, gravel pits; garbage men; deckhands; laborers in orange and apple groves and greenhouses; section hands; wood choppers; coal mine operatives; levee workers; CCC Camp workers; fishermen; laborers engaged in clearing land, road work, digging dredge ditches.

(3) **Domestic and personal service:** Beauty parlor operators; worker at steam table in cafeteria; barber; manicurist; chef; hotel clerk; elevator tender; waitress; practical nurse; cook; waiter, soda jerker; laundry operative; laundress; trapper.

(4) **Drivers and carriers:** Delivery men; bus drivers; truck drivers; taxi drivers; draymen; haulers; tractor drivers; rural mail carriers; postmen; highway maintenance men.

(5) **Factory operatives and laborers:** Operatives and laborers in all factories and plants, as candy, auto, shoe, bag, cheese, etc.; bakers and their assistants; sawmill workers; ginners.

(6) **Machine and related trades:** Machinists; pattern makers; thread cutters; engineers (stationary); linesmen; crane operators; blacksmiths; plumbers; rail bridge inspectors; concrete inspectors; carpenters; painters; roofers; paper hangers; metal welders; signal maintainers; electricians; marble setters; cabinet makers; pipe fitters; watch makers; millwrights; locksmiths; street car motormen; telephone operators; railroad brakemen; dressmakers; oil drillers; firemen for railroad; aviators; railroad switchmen, mechanic.

(7) **Professional service:** Pharmacists, chiropractors; chemists; lawyers; teachers; trained nurses; preachers; dentists; home demonstration agents; agricultural engineers; surveyors; dieticians; county agents; physicians; photographers; recreational leaders; social workers; leader of Federal Housing Survey.

(8) **Proprietors and managers:** All proprietors and managers; boarding house keepers; railroad butch; peddler.

(9) **Salesmen:** Insurance agents; lumber graders; filling station attendants; cotton buyers; cattle traders; sales agents; purchasing agents; cotton classers; clerks in stores; commercial travelers.

(10) **Soldiers, sailors, watchmen, etc.** Watchmen; constable; sailor; policemen; soldiers; firemen (city); convict guard; truant officer; guard in State and Federal buildings; caretakers.

(11) **Supervisory service:** Railroad conductor; matrons; supervisors; inspector (of work of others); assistant road contractor; floorwalkers; foremen; assistant managers.

(12) **Without occupation:** Those living on pensions or rent from property; invalids.

The classification used resembles in many respects Counts' classification of occupations although his is more an industrial classification than is this classification.¹ Counts has, for instance, one grouping entitled "Transportation Service" in which he includes sailors, brakemen, motormen, engineers, chauffeurs. Another grouping which he calls "Miscellaneous Trades in Manufacturing and Mechanical Industries" includes bakers, tailors, tanners, weavers, cobblers, cigar makers and the like.

"Machine and related trades," one of the titles to be used in this "character of work" classification, is an industrial rather than an occupational title. However, in the main it includes only skilled trades and does suggest the character of the work done. "Skilled wage workers" is a title reserved for a grouping to be used in Classification No. II.

It was occasionally difficult to classify the occupation of the son and daughter given by the family. For instance, some gave information such as the following: "work in street car shops, work at gravel pit, work in filling station." A few families were unable to furnish more detailed information than this even after further questioning. Fortunately, general information concerning the occupations of their children was usually sufficient to make the broad classifications of occupations used in this study.

When there was a mixture of types of duties in an occupation, the occupation was classified in the group in which the greatest time was spent. For instance, a filling station attendant may do some mechanic work, some common labor, but his main job is waiting on the trade. Therefore, his occupation was classified as salesman. Those who were unemployed were classified according to their last occupation.

APPENDIX G

DEFECTS OF THE HANDICAPPED

The handicapped included the following: the insane, epileptic, feeble minded, cretins; those subject to frequent and severe spells of hysteria; those with hare lip and cleft palate; the cripple (by accident, disease, "jake paralysis" or from other causes); those minus or without use of a limb or thumb; those with paralysis of the face, face drawn to one side; the hunch backs;

¹A. D. Mueller, "A Vocational and Socio-educational Survey of Graduates and Non-graduates of Small High Schools of New England." *Genetic Psychological Monograph* (October, 1929) VI. No. 4, pp. 313-95.

those with severe asthma, goiter, or kidney, heart, stomach, and intestinal difficulties; drug addicts; those with active or arrested cases of tuberculosis; those with one lung only; those with extremely abnormal conditions of the eye including total blindness in one eye.

APPENDIX H

CLASSIFICATION OF NON-FARMING OCCUPATIONS

(Social-economic Status Classification—No. II)

Managers, Clerks and Kindred Workers

Bookkeeper; cashier; mail clerk; shipping clerk; bank cashier; bank teller; stenographer; station agent (small town); filing clerk; record keeper; secretary of Chamber of Commerce; postmaster (in very small town); collector; enumerator; clerk not in stores; hotel clerk; postman; rural mail carrier; insurance agent; lumber grader; filling station attendant; cotton buyer; cattle trader; sales agent; purchasing agent; cotton classer; clerk in stores; commercial traveler; managers and their assistants.

Independent Business Men and Women

All proprietors including boarding house keeper; railroad butcher; peddler.

Professional Men or Women

Pharmacist; chiropractor; chemist; lawyer; teacher; trained nurse; preacher; dentist; home demonstration agent; agricultural engineer; surveyor; dietitian; county agricultural agent; physician; photographer; recreational leader; social service worker; leader of Housing Survey.

Skilled Laborers

Beauty parlor operator; barber; chef; baker; sawyer; machinist; pattern maker; engineer (stationary); crane operator; blacksmith; plumber; railroad bridge inspector; concrete inspector; carpenter; painter; roofer; paper hanger; cabinet maker; metal welder; electrician; marble setter; pipe fitter; millwright; watchmaker; locksmith; dressmaker; fireman for railroad; assistant road contractor; aviator; city fireman; mechanic; railroad conductor; floor-walker; inspectors, supervisors and foremen of machine and manufacturing shops.

Semi- and Unskilled Laborers

Assistants or helpers in laying gas, water and power lines, concrete roads, steel rails; laborers in oil fields, sandpits, gravel pits; garbage men; deck hands; laborers in orange and apple groves, in greenhouses; section hand; wood chopper; coal mine operator; levee worker; CCC Camp worker; fisherman; laborers engaged in clearing land, road work, digging dredge ditches; worker at steam table in cafeteria; manicurist; elevator tender; waitress; practical nurse; cook; waiter; soda jerker; laundry operative; laundress; trapper; delivery man; bus driver; truck driver; taxi driver; drayman; hauler; tractor driver; highway maintenance man; factory operative or laborer; matron; inspector (as inspector of premises for city Board of Health); saw mill worker; cotton gin worker; thread cutter for railroad; linesman; supervisor and foreman (as section foreman); street car motorman; telephone operator; caretaker; oil driller; watchman; railroad switchman; constable; sailor; policeman; soldier; convict guard; truant officer; guard in State and Federal buildings; signal maintainer; railroad brakeman.

APPENDIX I

CONSTRUCTION OF INDEX NUMBERS

The price of cotton each year from 1900 up to the present time is expressed as a relative, the average price of cotton during a 5-year period (1910-14) served as the base.

Table 127. Price per Pound of Cotton Received by Producers in the United States 1900-34
(Average price in 1910-14=100)

Year	Price of cotton per pound ^a	Price of cotton (relative)
1900	9.15	83
1901	7.03	64
1902	7.60	69
1903	10.49	96
1904	8.98	82
1905	10.78	98
1906	9.58	87
1907	10.36	94
1908	9.01	82
1909	13.60	124
1910	13.95	127
1911	9.60	87
1912	11.49	105
1913	12.50	114
1914	7.36	67
1915	11.22	102
1916	17.34	158
1917	27.12	247
1918	28.93	264
1919	35.41	322
1920	15.92	145
1921	17.01	164
1922	22.87	208
1923	28.69	261
1924	22.91	209
1925	19.59	178
1926	12.47	114
1927	20.19	184
1928	17.99	164
1929	16.79	153
1930	9.46	86
1931	5.66	52
1932	6.52	59
1933	9.17	84
1934	12.00	109

^aU. S. Department of Agriculture, Yearbook of Agriculture, 1934, p. 459.

APPENDIX J

SUPPLEMENTARY TABLES

Table 128. County of Residence of Sons and Daughters at the Time of Leaving School
Classified by Their Type of Occupation

County of residence	Number of sons				Number of daughters			
	Non-		Part-time		Non-		Part-time	
	Farming	farming	farming	Total	Farming	farming	farming	Total
Jefferson Davis	100	12	13	125	104	38	6	148
Lauderdale	75	49	3	127	85	50	9	144
Tate	65	45	11	121	76	45	9	130
Webster	82	16	20	118	76	16	8	100
Sunflower	56	30	8	94	55	34	8	97
Lawrence	7	—	—	7	14	1	1	15
Covington	8	1	—	9	5	—	1	6
Montgomery	7	—	—	7	4	1	—	5
Simpson	2	—	1	3	4	—	—	4
Lafayette	2	—	—	2	4	—	—	4
Itawamba	2	—	—	2	3	1	—	4
Monroe	3	3	1	7	2	1	—	3
Calhoun	7	—	1	8	2	1	—	3
Forrest	1	—	—	1	1	—	2	3
Lamar	4	1	—	5	2	1	—	3
Kemper	1	—	—	1	3	—	—	3
Alcorn	—	2	—	2	1	1	—	2
Yalobusha	3	1	—	4	2	—	—	2
Quitman	—	—	1	1	2	—	—	2
De Soto	1	—	—	1	1	—	—	1
Newton	1	1	—	2	—	1	—	1
Neshoba	2	—	1	3	—	1	—	1
Choctaw	3	—	1	4	1	—	—	1
Chickasaw	3	—	—	3	—	—	1	1
Clarke	—	2	—	2	1	—	—	1
Jones	—	1	—	1	1	—	—	1
Clay	—	1	—	1	—	1	—	1
Humphreys	—	—	—	—	1	—	—	1
Marion	5	—	—	5	1	—	—	1
Winston	3	—	—	3	1	—	—	1
Attala	3	—	—	3	1	—	—	1
Rankin	—	—	1	1	—	—	—	—
Oktibbeha	4	1	—	5	—	—	—	—
Lee	—	—	2	2	—	—	—	—
Bolivar	—	—	1	1	—	—	—	—
Panola	2	1	—	3	—	—	—	—
Carroll	4	2	—	6	—	—	—	—
Leflore	3	3	—	6	—	—	—	—
Washington	2	1	—	3	—	—	—	—
Perry	3	—	—	3	—	—	—	—
Scott	3	—	—	3	—	—	—	—
Pontotoc	1	—	—	1	—	—	—	—
Total	468	173	65	706	453	193	44	690

Table 129. Occupational Histories of Non-farming Sons Since Leaving Public School
Classified by Their Occupation

Occupational histories	Kind of occupation					All sons
	Unskilled and semi-skilled laborers	Skilled laborers	Managers, clerks and kindred workers	Professional men	Independent business men	
Farmer; unskilled and semi-skilled laborers	25	—	—	—	—	25
Unskilled and semi-skilled laborers only	15	—	—	—	—	15
Farmer; managers, clerks and kindred workers	—	—	13	—	—	13
Farmer; skilled laborers	—	12	—	—	—	12
Skilled laborers; unskilled and semi-skilled laborers	6	4	—	—	—	10
Managers; clerks and kindred workers only	—	—	9	—	—	9
Vocational course; skilled laborers	—	4	—	—	—	4
Skilled laborers only	—	4	—	—	—	4
Farmer; vocational course; managers, clerks and kindred workers	—	—	3	—	—	3
College; professional service	—	—	—	3	—	3
College; unskilled and semi-skilled laborers	3	—	—	—	—	3
College; managers, clerks and kindred workers	—	—	2	—	—	2
Farmer; vocational course; skilled laborers; independent business men	—	—	—	—	2	2
College; farmer; managers, clerks and kindred workers	—	—	2	—	—	2
College; farmer; professional service	—	—	—	2	—	2
Farmer; skilled laborers; managers, clerks and kindred workers; independent business men	—	—	—	—	2	2
College; skilled laborers; managers, clerks and kindred workers	—	—	2	—	—	2
College; farmer; unskilled and semi-skilled laborers	2	—	—	—	—	2
All other combinations ^a	21	6	8	3	7	45
Total	72	30	39	8	11	160

^aCombinations of occupations in which there was but one case.

Table 130. Occupations of Physically and Mentally Handicapped Sons Classified by Their Handicap

Handicaps	Farmers	Common laborers	Salesmen	Drivers and carriers	Factory operative and laborer	Totally incapacitated	All sons
Crippled	10	—	—	—	—	3	13
Partially blind or very abnormal eye condition	6	—	—	1	—	—	7
Mental defects	3	1	—	—	—	2	6
Chronic diseases or infections	2	—	1	—	—	2	5
Paralysis of face	—	—	—	—	1	—	1
Active or arrested tuberculosis	1	—	—	—	—	—	1
Drug addict	—	—	—	—	—	1	1
Total	22	1	1	1	1	8	34

Table 131. Occupations of Physically and Mentally Handicapped Daughters Classified by Their Handicap

Handicaps	Farm-home assistants	House-wives	Clerical service	Totally incapacitated	All daughters
Mental defects	—	—	—	5	5
Crippled	2	1	1	—	4
Chronic diseases or infections	3	—	—	—	3
Partially blind of very abnormal eye condition	—	2	—	—	2
Congenital deformities	2	—	—	—	2
Active or arrested tuberculosis	—	—	1	—	1
Total	7	3	2	5	17

Table 132. Occupations of Widowed and Divorced Sons

Occupation	Widowed sons	Divorced sons ^a	All sons
Farmer	4	5	9
Proprietor and manager	—	2	2
Personal and domestic service	—	1	1
Common labor	—	1	1
Machine and related trades	1	—	1
Total	5	9	14

^aThere was a handicapped son who was divorced. However, he was included in the handicapped group, as his divorce was a result of his handicap.

Table 133. Occupations of Widowed and Divorced Daughters, of Daughters with Invalid Husbands, and of Unwed Mothers

Occupations	Widowed daughters	Divorced daughters	Husband invalid	Unwed mothers	All daughters
Farm-home assistants	2	8	—	2	12
Housewife	—	—	3	—	3
Factory operative and laborer	—	2	—	—	2
Professional service	1	—	—	—	1
Farmer	1	—	—	—	1
Machine and related trades	—	1	—	—	1
Total	4	11	3	2	20

A Compilation of
Experimental Data
on

BOLL WEEVIL CONTROL

Compiled by
C. F. CLARK
Coordinator Research Information

Jointly Representing
Mississippi Agricultural Experiment Station
and
Mississippi State Vocational Board

J. R. Ricks, Director,
Mississippi Agricultural Experiment Station
State College, Mississippi.

THIS IS A REPORT OF
BOLL WEEVIL CONTROL WORK DONE IN OKLAHOMA BY U. S. BUREAU
OF ENTOMOLOGY AND PLANT QUARANTINE, UNITED STATES DE-
PARTMENT OF AGRICULTURE

INTRODUCTION AND GENERAL CONDITIONS

In 1928, the United States Bureau of Entomology, in cooperation with the Oklahoma Agricultural Experiment Station, began a series of experiments on boll weevil control. These experiments were of necessity moved from place to place year after year, since fields had to be selected that were infested with weevils and that were of uniform soil fertility.

Since these experiments were conducted on different fields each year and since the conditions vary widely, the results are reported separately for each field each year, except that the work on some fields is omitted on account of its similarity to results on some other fields.

With each experiment is reported the date on which infestation counts are made (at the top of the column), the percent weevil infestation on that date, the date on which poison applications are made and the number of squares and bolls per stalk on or near the dates on which the infestation counts are made. **The poison dates are reported as follows:** The lower figure represents the percent weevil infestation. The figures above and to the **right** of the infestation count represent the number of days **after** the date at the head of the column on which poison was applied. The figures appearing to the **left** of the infestation count represent the number of days **before** date at head of column on which poison was applied. For example:

July 27	
	(1,5)
36	

means that on July 27 the weevil infestation was 36% and that an application of poison was made one day and five days later, or on July 28 and August 1, respectively; while:

July 27	
(14,1*,0)	
22	

signifies that on July 27 the infestation was 22% and that poison applications were made 14 days and one day before and on the same date as July 27 and that the application made the day before (1*) was rained off within 24 hours after the application was made. In other words, applications were made on July 13, July 26 and July 27 and that the application on July 26 was rained off within 24 hours after application.

No cuts are reported that seem to be practically a duplication of another cut reported in the same year and locality.

The molasses-calcium arsenate mixture (1-1-1) consisted of one gallon of good grade table syrup, one pound of calcium arsenate and one gallon of water. Two applications of this mixture were made as a pre-square treatment on both of the treated plots of each of the three plot tests, one plot being left untreated as a check to determine the effects of the two methods of treatment. The dust applications of calcium arsenate were started when the infestation reached 10% and continued at four or five day intervals as long as the infestation remained 10% or more. These applications were limited to five to seven pounds per acre.

A careful survey was made of each cut to determine the uniformity of the soil and the stand of cotton. The ideal cut would consist of rows butting into timber land so as to give each plot an equal chance to be infested by the weevils as they emerged from hibernation. Each plot contained from 32 to 38 rows, which were from 300 to 400 feet long.

The first records made in these tests were plant infestations, square infestations and plant counts. The pre-square applications of 1-1-1 mixture were to be applied just before the squares were large enough to attract the weevils from the bud of the small plant. All of these 1-1-1 applications were made with buckets and mops with an effort to get the material in the top of the plant without breaking the terminal bud. All dust applications were made with hand dust guns. When an application of either the dust or molasses poison was washed off by rain within twenty-four hours after it was applied, the application was renewed.

Appreciation is due the United States Bureau of Entomology and Plant Quarantine for the privilege of publishing the results of their work in Oklahoma. Appreciation is due Mr. H. C. Young, Junior Entomologist of the Bureau, for furnishing minute records of the work, for his courtesy in checking this manuscript and making valuable suggestions.

Suggestive: (To be used as a guide in the study of experiments)

1. Does it usually pay to poison for the control of boll weevils?
 - a. In what percentage of cases did any given method of poisoning give enough cash gain over cost to be attractive?
 - b. In what percentage of cases did any of the methods used fail to pay for the cost of poison?
2. Does it pay to poison cotton that will produce only a low yield?

In how many cases that it paid to poison was the yield below 400 pounds seed cotton on the check plot? (300 pounds, or any other given amount)
3. Does it pay to poison where the infestation does not go above 50% until after the cotton is practically mature?

In how many cases where the poison failed to pay did the infestation reach 50% only comparatively late in the season.
4. Does it pay to poison where the conditions are favorable for boll weevil development when the infestation reaches 10%?
5. Do control measures tend to keep down infestation:

How does infestation on control plots compare with that on check plots after poisoning begins?

Use the following form for determining the gain or loss for each treatment.

Suggested Form For Analyzing Results of Boll Weevil Control Experiments

[illegible]

1928 RESULTS

Wynnewood

Wynnewood is in Garvin County on about the same latitude as the following Mississippi counties: Coahoma, Panola, Lafayette, Union and Prentiss.

The rainfall for the season was considered heavy until the first of August. There was very little rain during August, September and October.

These experimental cuts were treated in accordance with the standard methods of procedure that has been developed at the Delta (Tallulah) Laboratory as given in U. S. D. A. Leaflet No. 37. The object was to study so far as possible, (a) the history of the development and increase of weevils under Oklahoma conditions and, (b) to determine the efficacy of the molasses-calcium arsenate (1-1-1) applications made throughout the growing season as compared with two applications of pre-square poisoning (1-1-1) followed by calcium arsenate dust treatment starting these applications when the weevil infestation reached 10%.

CUT A

This cut was bordered on the north and west by timber and on the south and east by cotton. The land was level with a fairly uniform soil that should produce a bale of cotton per acre without insect damage. Delfos cotton was planted here April 26. The cotton was hoed three times and plowed six times. There was a good stand of cotton at the time the plots were staked out.

There were 600 squares examined in each plot each week throughout the season or until there were less than two squares per plant.

CUT C

This cut was located on good fertile soil of comparatively new land in a small valley. There was plenty of mulch for producing thrifty plants. The cut was bordered on the north and west by cotton, on the east by potatoes and corn and on the south by corn. It was planted to "gin run" cotton seed supposed to be a mixture of Lone Star and Mebane varieties. It was chopped to a stand of one to two plants every 12 to 20 inches. The cotton apparently did not suffer any from lack of cultivation or from the long dry period in August and September. Plot 1 was left untreated as a check and plots 2 and 3 were treated with the molasses and dusting method respectively.

It is very doubtful if the last two dust applications were advisable or at all profitable since the infestation showed that field migration of weevils started about the first of August or four weeks prior to the last two applications of poison. Two applications were washed off by rain, one on July 27 and the other August 3. There was a light to heavy dew for nine of the eleven applications.

TABLE 1 —BOLL WEEVIL CONTROL EXPERIMENTS AT WYNNEWOOD, OKLAHOMA

Plot 1—Check, no poison.

Plot 2—Two pre-square applications molasses mixture (1-1-1) followed b. molasses mixture weekly throughout season.

Plot 3—Two pre-square applications molasses mixture (1-1-1) followed b. calcium arsenate dust after 10% infestation.

Plot No.	Yield in Lbs. Seed Cotton Per Acre	Lbs. or Gallons Poison Applied Per Acre	Man Hours Required Per Application	July 2	July 10	July 17	July 24	July 30	August 7	August 13	August 20	August 30	Sept. 1
Randolph, Cut A													
1	1320			2	3	0	6	11	46	92	95		
				(5)	(3)	(1, 6)	(4*, 6)			(2)	(1)		
2	1380	11.63 a	2	.2	0	0	2	5	28	81	89		
				(5)	(3)		(1*, 2)	2	(1)	(2)	(4)	(1, 8)	
3	1437	2.1 a 50.3 b	2.42 1.16	.5	3	.2	9	9	9	57	74		
Manning, Cut o													
1	720			4	1	5	20	30	72	86	93		
				(4)	(4)	(1, 6)	(4*, 6)	(6)	(5)	(2)	(1)		
2	970	11.7 a	1.8	4	.5	3	16	13	48	76	77	91	
				(4)	(4)		(1, 6)	(3*, 6)	(4, 7)	(2)	(4)	(1, 8)	(2)
3	1500	2.04 a 87.24 b	1.9 1.1	3	.8	8	13	9	28	34	40	63	

o—Randolph, Cut B is omitted because of its similarity to Cut A.

a—Gallons molasses mixture used.

b—Pounds calcium arsenate dust used.

*—Rained off in 24 hours.

There was very little difference in the average height of 600 stalks per plot on August 17 or in the number of plants per acre on September 5 between the various plots of the same cut.

Climatological Data for Cuts A and C

June 26 — .21 inch rain	July 27 — .05 inch rain
June 27 — .44 inch rain	July 30 — Clear
June 28 — .24 inch rain	July 31 — E. wind, light dew, clear
June 29 — S. wind, partly cloudy	Aug. 3 — South wind, no dew, clear
June 30 — Trace of rain	Aug. 4 — .13 inch rain, cloudy
July 5 — S. wind, clear	Aug. 6 — .22 inch rain, south wind, heavy dew, clear
July 6 — Clear	Aug. 9 — No wind, heavy dew, clear
July 8 — Trace rain	Aug. 14 — Partly cloudy
July 9 — 1.19 inches rain	Aug. 17 — No wind, light dew, clear
July 11 — Clear	Aug. 18 — .11 inch rain
July 13 — .02 inch rain	Aug. 21 — No wind, heavy dew, clear
July 15 — .66 inch rain	Aug. 24 — .07 inch rain
July 16 — A cloudy; C clear	Aug. 25 — .20 inch rain
July 21 — Cloudy	Aug. 26 — .02 inch rain
July 22 — .72 inch rain	Aug. 28 — No wind, heavy dew, clear
July 23 — Partly cloudy	Aug. 30 — .52 inch rain
July 25 — Trace rain, E. wind, heavy dew, partly cloudy	Aug. 31 — .48 inch rain
July 26 — .50 inch rain, no wind, heavy dew, partly cloudy	Sept. 1 — No wind, heavy dew, clear

Durant

Durant is in Bryan County, Oklahoma, and is bisected by latitude 34°, which also passes through the following Mississippi counties: Bolivar, Coahoma, Tallahatchie, Yalobusha, Calhoun, Chickasaw and Monroe.

The soil in all of these cuts was a little above the average for this locality and would produce about one half to three-fourth bale per acre without insect damage.

Cut A

This cut was bordered on the north by a fence and public road, on the east by a fence and timber, on the south by cotton in Cut B and on the west by cotton. The land was almost level with the rows butting into the timber. This cut was planted to "gin run" seed of mixed varieties and came up to a fair stand. There were a few spots on the north side where the stand was not uniform but this was not very noticeable at the time the cut was staked out. No fertilizer was applied to this cut. The cotton was chopped to a space of one plant for each 20 inches or more. The cut received clean cultivation throughout the growing season.

Cut B

Cut B was located just south of Cut A and was bordered on the east by fence row and timber, on the south by cotton and oat field and west by cotton. The soil here was a sandy loam gravel type of little more than average fertility. The rows were parallel to those of Cut A extending toward the weevil hibernation quarters in the timber on the east end.

Cut D

This cut was bordered on the north by timber, on the east by pastureland, on the south and west by cotton. The soil here was of a dark prairie type of a fertility that would produce a little more than half bale per acre without insect damage. The cotton was spaced with one to two plants every 15 to 24 inches. This cut received clean cultivation, throughout the season.

TABLE 2—BOLL WEEVIL CONTROL EXPERIMENT AT DURANT, OKLAHOMA

Plot 1—Check, no poison.

Plot 2—Two pre-square applications molasses mixture (1-1-1) followed by molasses mixture weekly throughout season.

Plot 3—Two pre-square applications molasses mixture (1-1-1) followed by calcium arsenate dust after 10% infestation.

Plot No.	Yield in Lbs. Seed Cotton Per Acre	Total Lbs. or Gallons Applied Per Acre	Man Hours Required Per Application	July 4	July 8	July 16	July 23	July 30	August 6	August 13	August 20	August 27
Hatcher, Cut A												
1	813			6	4	3	15	26	33	68	79	
				(5)	(2)		(4)	(2)	(2)	(0)		
2	860	11.21 a	3	1	0	3	7	10	11	48	65	
				(5)	(2)		(1, 5)	(4)	(1)		(1, 5)	
3	898	3.07 a 43.87 b	5 2.1	2	0	0	14	18	3	10	60	
Hatcher Cut B												
Percent Weevil Infestation												
1	579			7	6	5	23	45	35	77	76	84
				(2)	(3*, 5)		(4)	(4)	(2)	(1)	(0)	
2	866	10.95 a	2.5	4	1	1	10	18	17	57	70	80
				(2)	(3*, 5)		(1, 5)	(4)	(1)		(1, 5)	
3	910	3.45 a 43.08 b	2.6 1.8	5	1	2	20	18	2	18	53	47
Horn, Cut D												
Percent Weevil Infestation												
				July 11	July 16	July 23	July 30	August 6	August 13	August 20	August 27	
1	578			1	0	3	9	11	13	52	82	
				(8, 2)	(3)		(4)	(2)	(1)	(0)		
2	751	10.38 a	2.9	.3	0	7	7	1	11	59	82	
				(8, 2)		(4)	(2)	(0)	(1)	(3)		
3	845	2.88 a 34.96 b	3.3 2.5	0	1	9	12	11	7	29	64	

d—Horn, Cut C was omitted because of its similarity to Cuts A and B.

a—Gallons molasses mixture used.

b—Pounds calcium arsenate dust used.

*—Rained off in 24 hours.

INFORMATION SUPPLEMENTARY TO THE DURANT, OKLAHOMA BOLL WEEVIL CONTROL WORK

	Average Height of 600 Plants on August 15			Plants Per Acre August 28		
	Cut A	Cut B	Cut D	Cut A	Cut B	Cut D
Plot 1	29.94	28.29	24.44	11,215	11,117	9,495
Plot 2	25.83	28.38	26.66	11,196	11,250	7,773
Plot 3	22.99	27.93	22.74	11,441	11,468	9,032

Climatological Data for Hatcher Cuts A and B and Horn Cut D

June 28 — .25 inch rain	July 28 — Clear
June 30 — Clear	July 29 — .12 inch rain
July 2 — Clear	July 31 — Clear
July 3 — Clear	Aug. 1 — Clear
July 6 — Cloudy	Aug. 3 — Cloudy
July 7 — Cloudy	Aug. 5 — .05 inch rain
July 8 — .51 inch rain	Aug. 6 — 1.55 inch rain
July 9 — .30 inch rain	Aug. 7 — Clear
July 10 — Clear	Aug. 13 — Clear
July 15 — .01 inch rain	Aug. 14 — Cloudy
July 16 — .20 inch rain	Aug. 18 — 1.81 inches rain
July 20 — Clear	Aug. 19 — .02 inch rain
July 23 — .18 inch rain	Aug. 21 — Clear
July 24 — Clear	Aug. 24 — .32 inch rain
July 26 — .80 inch rain	Aug. 25 — Cloudy
July 27 — Cloudy	Aug. 31 — .08 inch rain

SUMMARY OF 1928 BOLL WEEVIL POISONING WORK

Plot 1—Check, no poison.

Plot 2—Two pre-square applications molasses mixture, (1-1-1) followed by molasses mixture weekly throughout season.

Plot 3—Two pre-square applications molasses mixture, (1-1-1) followed by calcium arsenate dust after 10% infestation.

Wynnewood	Yield in Pounds Seed Cotton			Total No. Poi- son Applications		Total Lbs. or Gals. Poison ap- plied Per Acre	
	Plot 1	Plot 2	Plot 3	Plot 2	Plot 3	Plot 2	Plot 3
Randolph, Cut A	1320	1380	1437	10*	9*	11.63 a	2.1 a 50.3 b
Manning, Cut C	720	970	1500	10*	13**	11.7 a	2.04 a 87.24 b
Durant							
Hatcher, Cut A	813	860	898	8	8	11.21 a	3.07 a 43.87 b
Hatcher, Cut B	579	866	910	9*	9*	10.95 a	3.45 a 43.08 b
Horn, Cut D	578	715	845	8	7	10.38 a	2.88 a 34.96 b

*—One application rained off within 24 hours after being applied.

a—Gallons of molasses mixture (1-1-1) applied per acre.

b—Pounds of calcium arsenate dust applied per acre.

1931 RESULTS

Hugo:

Hugo, Oklahoma is bisected by latitude 34°, which also passes through the following Mississippi counties: Bolivar, Coahoma, Tallahatchie, Yalabusha, Calhoun, Chickasaw and Monroe.

Seven cuts were located in Choctaw County, southeast of Hugo on bottom land along the Red River. These cuts were staked out between July 1 and 16. Cuts A and B were discontinued on July 16 on account of irregularity of plant growth and Cuts E and F were staked out on this date. Cuts C, E, F, and G were carried through the remainder of the season. The soil in Cuts C, E, and F was of a black waxy nature and usually produces a good yield of cotton. The soil in Cut G was a yellow gumbo and produces good yields of cotton provided there is light rainfall to check the plant growth. The bottom land in this locality usually produces from 800 to 1500 pounds of seed cotton per acre without insect damage. This particular section has suffered severe weevil damage during some of the past years, especially 1926-28 inclusive, but during 1929 and 1930 there was very little damage on account of the dry weather during the growing season. Hibernation quarters are numerous and the cotton plants usually shade the ground well after July 10. The emergence of over-wintered weevils was light and the dry hot weather in June causes a high mortality in the early punctured squares, but after a few rains in early June a fair infestation developed. Owing to the very favorable weather conditions during 1931 the average productions of this locality were exceedingly good, the best since 1925.

Cut C

This cut was located in the northeast portion of a ten acre field which was bordered on the east by timber, on the south and west by brushy fence rows, and on the north by cotton. A cabin and several out houses were located in the western edge of the field. This field was planted to cotton in 1930, and prior to that it was in alfalfa for several years. The land was almost level and was planted to Oklahoma Triumph 44 cotton on April 15. This cotton received clean cultivation throughout the season, being hoed twice and plowed three or four times. The last cultivation was July 15.

Cut E

This cut was located in the northwest portion of a twenty acre field which was bordered on all sides by corn. Woodland was from $\frac{1}{4}$ to $\frac{1}{2}$ mile distant on the south and west sides. This field was planted to cotton in 1929 and 1930. The land was almost level with exceptionally good drainage and was planted to Delfes cotton about April 10. This cotton received three or four cultivations with the plow and two with the hoe which was sufficient to keep it clean with the exception of many weeds and cockleburrs which made enormous growth during August and September. The last cultivation was made on July 3. This cut was staked out on July 16 and at that time the infestation ranged from 17.3% to 26.8% in the various plots.

Cut F

This cut was located in the southwest portion of the same twenty acre field in which Cut E was located or immediately south of Cut E. The conditions are practically the same as Cut E. It was staked out on July 16 and at that time the infestation in plot 1 was 20.7% and in plot 2, 25.5%.

Cut G

This cut was located in the northwest portion of a six acre field which was bordered on the north by woodland, and on the east, south and west by corn. Woodland was $\frac{1}{4}$ to $\frac{1}{2}$ mile distant on the south and west. This particular field was planted to corn in 1930 but there was considerable cotton in this immediate vicinity in 1930. The soil in this cut was different from that in the other cuts in this county, being a yellow gumbo soil, very fertile and produces a heavy vegetable growth when there is normal rainfall during the growing season. The land was almost level and was planted to Russell Big Boll cotton, a big boll, late maturing variety, about April. 27. This cotton received four or five cultivations with plow and two with the hoe which were sufficient to keep it clean through the season. The last cultivation was on August 10.

TABLE 3—BOLL WEEVIL CONTROL EXPERIMENTS AT HUGO, OKLAHOMA

Plot 1—Check, no poison

Plot 2—Molasses mixture at weekly intervals throughout season.

Plot 3—Calcium arsenate dust after 10% infestation.

Plot No.	Yield in Lbs. Seed Cotton Per Acre	Total Lbs. or Gallons Poison Applied Per Acre	Man Hours Required Per Acre Application	July 2	July 9	July 16	July 23	July 28	August 5	August 12	August 19	August 25
Barriek, Cut C												
Percent Weevil Infestation												
1	1214			11	11	8	10	16	23	45	88	
2	1206	10.55a	1.66	(0)	7	(0)	4	(0)	(0*,1*,4)	(6)	(5)	(5)
3	1584	49.43b	1.0	7	4	14	10	9	(1*,4*)	(0,4)	(3)	(1)
Brewer, Cut E (No Pre-square application of molasses mixture)												
Percent Weevil Infestation												
1	901					21	14	22	38	45	83	
2	928	8.43a	1.6			27	20	17	(1*,4)	(6)	(5)	(5)
3	1435	44.69b	1.0			17	13	8	(2)	(0,4)	(1,6)	(3)
Brewer, Cut F (Plot 2 omitted, no pre-square application of molasses mixture)												
Percent Weevil Infestation												
1	848			July 16	July 23	July 28	August 3	August 12	August 19	August 25		
3	1532	47.49	1.0	21	19	14	18	23	53			
Russell, Cut (Plot 2 omitted, No pre-square application of molasses mixture. This cut had a lower infestation early in the season than Cut F. Planting late: Cut F, April 10, Cut G, April 27)												
Percent Weevil Infestation												
1	498			9	20	123	22	32	63	64		
3	794	53.5b	1.21	10	11	21	17	21	(3)	(3*,6)		

a—Gallons molasses mixture used.

b—Pounds calcium arsenate dust used.

*—Rained off in 24 hours.

INFORMATION SUPPLEMENTARY TO HUGO CUTS C, E, F, AND G

	Average Height of 600 Plants in Inches on August 17*				Number of Plants Per Acre on September 7			
	Cut C	Cut E	Cut F	Cut G	Cut C	Cut E	Cut F	Cut G
Plat 1	41.50	41.95	41.46	51.97	17,259	13,842	13,007	16,498
Plat 2	35.79	43.05			15,386	14,527		
Plat 3	40.97	42.65	45.42	52.8	15,059	15,694	15,117	16,316

*Not this same date for all cut, but other dates were within a few days of this time.

Climatological Data for Cuts C, E, F, and G

July 2 — Clear	July 27 — Clear
July 3 — Trace of rain	Aug. 1 — Clear
July 9 — .91 inch rain	Aug. 3 — Clear
July 10 — Cloudy	Aug. 6 — Clear
July 16 — Cloudy	Aug. 10 — Cloudy
July 17 — .27 inch rain, cloudy	Aug. 11 — Clear
July 18 — Cloudy	Aug. 15 — Clear
July 20 — Cloudy	Aug. 16 — .52 inch rain
July 21 — 2 inches rain	Aug. 17 — Cloudy
July 22 — Clear	Aug. 18 — .62 inch rain
July 23 — Clear	Aug. 20 — Clear
July 24 — .33 inch rain, cloudy	Aug. 22 — Clear
July 25 — 1.41 inches rain	Aug. 28 — 2.61 inches rain, cloudy
July 26 — Clear	Aug. 31 — Cloudy

Tishomingo:

Tishomingo is in Johnston County Oklahoma on about the same latitude as the following Mississippi Counties: Coahoma, Quitman, Panola, Lafayette, Pontotoc, Lee and Itawamba.

The five cuts were staked out in Johnston county on July 9, and owing to the lateness in starting the work no pre-square applications were made on any of these plots.

Cuts A, B, and C were located on fertile bottom land which produces a heavy vegetative growth and cotton continues to fruit on this type of soil through August. In this section, cotton made a late fall growth in 1930 and a fair population of weevils entered hibernation, and the emergence this year was above the average of other sections. The soil in Cuts D and E was not as productive as that in the other cuts and does not produce a sustained growth and fruits late in the season.

In this section of the state this year there was heavy weevil damage on soils such as were in Cuts A, B, and C, and the yields on this type of soil were less than in 1929 or 1930, but on soils typical of these in Cuts D and E there was light weevil damage and a greater yield than in 1929 and 1930.

Cut A

This cut was located in the northeast portion of a twenty acre field which was bordered on the east, north and west by timber and on the south by corn. This field was planted to cotton in 1930. The land was almost level and was planted to Sunshine cotton on April 23. This cotton received six cultivations with the plow and one with the hoe which was sufficient to keep it clean throughout the season. The last cultivation was during the latter part of July. The soil in this cut was a sandy loam, high in fertility, and was located along the Washita river.

Cut B

This cut was located in the northeast portion of an eight acre field which

was bordered on the south by a wooded slough, on the east and west by corn, and on north by cotton. This cut was approximately $\frac{3}{8}$ mile southeast of Cut A and $\frac{1}{4}$ mile northeast of Cut C. This land was almost level and was planted to Kasch cotton on April 20. This cotton received five cultivations with the plow and one with the hoe which was sufficient to keep it clean throughout the season. The last cultivation was during the latter part of July. The soil in this field was a fertile sandy loam such as occurs along the Washita river.

Cut C

This cut was located in the northeast portion of a fifteen acre field which was bordered on the north, east and south by woodland and on the west by corn. This field was planted to cotton in 1930. The land was almost level and was planted to Kasch cotton on April 25. This cotton received six cultivations with the plow and one with the hoe which was sufficient to keep it clean throughout the season. The last cultivation was during the latter part of July. The soil in this cut was a sandy loam of fair fertility but not as good as that in Cuts A or B in fertility and water holding capacity. This cut was staked out on July 9 and on July 13 the infestation in the three plots ranged from .3% to 3.8%.

Cut D

This cut was located in the east end of an eight acre field which was bordered on the east by woodland, on the north by corn, on the west by State Highway 12 beyond which was woodland and on the south by wasteland. This field was planted to corn in 1930 but the land immediately north which was planted to corn in 1931 was in cotton in 1930. The land was almost level and was planted to Kasch cotton on April 20. This cotton received five cultivations with the plow and one with the hoe which was sufficient to keep it clean throughout the season. The last cultivation was during the latter part of July. The soil in this cut was very sandy and of medium fertility but less productive than the soil in any of the other cuts located in this county.

The fruiting season of cotton on this type of soil is so short that it is necessary that there be a large emergence of over-wintered weevils to cause very much damage. This cut was staked out on July 9 and July 13 the infestation in the three plots ranged from 4.8% to 8.0%.

Cut E

This cut was located in the southwest portion of a ten acre field which was bordered on the north by wasteland covered with brush and grass, on the east by meadow with brushy wasteland $\frac{1}{4}$ mile distant, on the south by corn and on the west by a public road beyond which was Blue river with a dense undergrowth. This field was planted to cotton in 1930. The land was almost level and was planted to Bohemian Big Boll cotton about April 25. This cotton received four cultivations with the plow and one with the hoe which was sufficient to keep it clean throughout the season. The last cultivation was made during the latter part of July. The soil in this cut was a medium sandy loam being a typical representative of much of the tillable area which occurs along the Blue river but above the average of the sandy soils in fertility; however, less productive than the heavy clay soils that occur in this same region. Cotton on this type of soil matures early and does not make a late season growth.

TABLE 4—BOLL WEEVIL CONTROL EXPERIMENTS AT TISHOMINGO, OKLAHOMA

Plot 1—Check, no poison.

Plot 2—Molasses mixture (1:1:1) at weekly intervals throughout season.

Plot 3—Calcium arsenate after 10% infestation.

Plot No.	Yield in Lbs. Seed Cotton Per Acre	Total Lbs. or Gallons Poison Applied Per Acre	Man Hours Required Per A. Per Application	July 13	July 21	July 27	August 3	August 11	August 18	August 24	September 2
Chapman, Cut A (Plot 2 omitted)											
1	648			16	18	16	35	58	65	75	89
3	1441	86.88b	1.2	(1,6)	10	(1)	(1,4)	21	(1,5)	(1)	(0,6)
						1	32		19	35	63
Chapman, Cut B (Plot 2 omitted)											
1	535			6	9	31	40	64	67	84	
3	1222	59.18b	0.88	5	18	(1)	(1,4)	27	(1,5)	(1)	(0)
						14	19		22	25	
Chapman, Cut C											
1	501			4	6	30	44	59	65	85	
				(3)	(3*)	(1*)	(2)		(1)	(0*,1)	
2	690	14.80a	2.4	.3	2	10	34	*56	65	87	
3	972	57.2b	1.1	2	6	19	(1)	(0,4)	(1,5)	(1)	(0,6)
						21	15		20	29	
Chapman, Cut D											
1	652			8	9	19	37	57			
2	774	10.4a	2.8	(3	(3*,7*)	6	(2)	(2)			
				5	1		24				
3	811	24.08b	1.0	5	8	25	(1)	(0,4)			
							11				
Brashier, Cut E											
1	792			3	6	8	25	57	58	69	
2	905	62.8	1.0	5	5	7	(3)	(1,4)	(0*,1,4)	(4*,5)	
							31	42	31	23	

a—Gallons molasses mixture used.

b—Pounds calcium arsenate dust used.

*—Rained off in 24 hours.

INFORMATION SUPPLEMENTARY TO TISHOMINGO CUTS A, B, C, D, AND E

Plot No.	Average Height in Inches of 600 Plants on August 26†					Number of Plants Per Acre on October 2†				
	Chapman				Bra-shier	Chapman				Bra-shier
	Cut A	Cut B	Cut C	Cut D	Cut E	Cut A	Cut B	Cut C	Cut D	Cut E
1	56.10	38.29	42.23	32.8	45.91	13,824	14,633	13,139	17,323	17,937
2	.....	.....	37.65	32.8	.....	.....	.....	14,684	16,517	.....
3	53.10	36.93	40.52	33.9	43.89	13,829	18,842	13,915	16,819	17,449

*Not this same date for all cuts, but other dates were within a few days of this.

Climatological Data for Chapman Cuts A, B, C, and D and Brashier

Cut E

July 8 — 1.34 inches rain	Aug. 7 — Clear
July 14 — Cloudy	Aug. 10. — .22 inch rain
July 18 — .52 inch rain	Aug. 12 — Clear
July 19 — .05 inch rain, cloudy	Aug. 16 — Clear
July 22 — Cloudy	Aug. 18 — .54 inch rain
July 27 — Clear	Aug. 24 — Cloudy
July 30 — .15 inch rain	Aug. 28 — .04 inch rain
July 31 — .19 inch rain	Aug. 30 — Clear
Aug. 1 — Cloudy	Sept. 2 — .06 inch rain
Aug. 4 — .06 inch rain, cloudy	Sept. 3 — Clear
July 25 — .84 inch rain	Aug. 19 — .16 inch rain, cloudy

Forum:

Five cuts were located in the southern end of Muskogee County, south of Forum in the South Canadian river bottom. This is the same locality in which experiments were conducted in 1929. This locality is a typical representative of the Arkansas, North Canadian and South Canadian river bottoms that are found in the east and east central sections of the state. There is a large acreage of very fertile land along these rivers which is well adapted to cotton culture. Generally these bottoms are narrow and are bordered by timbered hillsides which offer an abundance of favorable hibernation quarters for the weevil. Throughout this section the season is considerably later and the winters more severe than in the extreme southeastern portion of the state. Cool weather during April and May retards growth, consequently its main fruiting season is considerably later than at Hugo and Tishomingo. Late growth in these bottoms, which is common, is favorable for the production of a large number of weevils to enter hibernation. The emergence of over wintered weevils was greater than in 1930 but not as heavy as in 1929; however, favorable weather conditions for weevil development prevailed during July and August and the cotton in these bottoms suffered heavy damage, many fields not producing more than one-half what they did in 1930.

Cut A

This cut was located in the southeast portion of a 20 acre field which was bordered on the south by a slough with trees and heavy underbrush, on the west by cotton, and on the north and east by corn. Timbered hillsides were about ¼ mile distant to the north. This same field has been continuously planted to cotton for a number of years and the Cut D experiment of 1929 was located in this same field. This land was planted to Oklahoma Triumph 44 cotton about April 27. This cotton received eight cultivations with the plow and two with the hoe which was sufficient to keep it clean throughout the year. The last cultivation was given about August 1.

Cut B

This cut was located on the west side of a twelve acre field which was bordered on the north and east by the slough with trees and heavy underbrush, on the west by corn and on the south by cotton with woodland $\frac{1}{4}$ mile distant. This cut was about 200 yards south of Cut A and 150 yards southeast of Cut C. This field was planted to cotton in 1929 and 1930. This land was planted with mixed seed mostly Delfos and Galloway varieties about April 27. This cotton received six cultivations with the plow and two with the hoe which was sufficient to keep it clean through the year. The last cultivation was given about July 15.

Cut E

This cut was located in the northwest portion of the same 20-acre field in which Cut A was located. This field was bordered on the south by a slough with trees and heavy underbrush, on the west by cotton, and on the north and east by corn. Timbered hillsides were about $\frac{1}{4}$ mile distant to the north. This field has been continuously cropped to cotton for a number of years. This land was planted to Oklahoma Triumph 44 cotton about April 27. This cotton received eight cultivations with the plow and two with the hoe which was sufficient to keep it clean throughout the year. The last cultivation was given about August 1.

TABLE 5—BOLL WEEVIL CONTROL EXPERIMENTS AT PORUM, OKLAHOMA

Plot 1—Check, no poison.

Plot 2—One pre-square application of molasses mixture (1-1-1) followed by 1 application molasses mixture (1-1-1) seven days later.

Plot 3—One pre-square application of molasses mixture (1-1-1) followed by calcium arsenate at 10% infestation, except where noted.

Hoos, Cut A (Plot 2 omitted)

Plot No.	Yield in Lbs. Seed Cotton Per Acre	Total Lbs. or Gallons Poison Applied Per Acre	Man Hours Required Per A. Per Application	July 10	July 13	July 20	July 27	August 6	August 15	August 19	August 25	Sept. 3
1	1106			8	7	10	19	46	43	65	81	
3 lbs	1429	61.9b	1.45	11	(1,5)	5	(5,9)	(3*,5)	13	(0,4)	33	
Percent Weevil Infestation												

Hoos, Cut B

Plot No.	Yield in Lbs. Seed Cotton Per Acre	Total Lbs. or Gallons Poison Applied Per Acre	Man Hours Required Per A. Per Application	July 10	July 13	July 20	July 27	August 6	August 15	August 19	August 25	Sept. 3
1	377			6	6	8	27	35	41	56	74	
2	515	2.55a	2.6	(11,4*,1)	2	.8	30	41	49	58	71	
3	1002	1.1a 54.9b	1.5	(11)	2	3	(5,9)	(3*,5)	(0)	(0,4)	32	
Percent Weevil Infestation												

Hoos, Cut E

Plot No.	Yield in Lbs. Seed Cotton Per Acre	Total Lbs. or Gallons Poison Applied Per Acre	Man Hours Required Per A. Per Application	July 18	July 23	July 29	August 6	August 10	August 17	August 25	September 1	September 8
1	906			4	9	28	44	45	59	76		
3 lbs	1305	61.0b	1.5	8	9	(1,6*,3)	(3*)	(1,5)	(2,6)	(3*,4)		
Percent Weevil Infestation												

lbs—No. pre-square application of molasses mixture.

a—Gallons of molasses mixture.

b—Pounds of calcium arsenate dust per acre.

INFORMATION SUPPLEMENTARY TO PORUM, OKLAHOMA, CUTS A, B, AND E

Plot	Average Height in Inches of 600 Plants, on September 3			Plants Per Acre on September 3		
	Cut A	Cut B	Cut E	Cut A	Cut B	Cut E
1	49.79	48.24	42.18	12,803	11,116	14,074
2		45.89			11,726	
3	47.18	49.93	43.86	13,509	10,931	14,310

Climatological Data for Hoos Cuts A, B, and E*

June 30 — Clear	Aug. 4 — 2.28 inches rain. cloudy
July 1 — Clear	Aug. 5 — Cloudy
July 4 — .35 inch rain	Aug. 8 — Clear
July 5 — .03 inch rain	Aug. 9 — Clear
July 6 — Clear	Aug. 10 — .39 inch rain, cloudy
July 8 — .13 inch rain	Aug. 11 — Clear
July 9 — 1.07 inch rain, cloudy.	Aug. 13 — Clear
July 13 — Clear	Aug. 17 — .69 inch rain. cloudy
July 14 — Clear	Aug. 18 — Cloudy
July 18 — .24 inch rain, cloudy	Aug. 19 — .51 inch rain, cloudy
July 19 — .90 inch rain	Aug. 23 — Clear
July 20 — Cloudy	Aug. 25 — .03 inch rain
July 21 — 1.89 inch rain, clear	Aug. 26 — .06 inch rain
July 24 — .15 inch rain	Aug. 27 — .07 inch rain
July 25 — 1.16 inch rain, cloudy	Aug. 28 — Cloudy
July 27 — Clear	Aug. 29 — Cloudy
July 29 — Clear	Sept. 2 — 1.33 inches rain
July 31 — Clear	Sept. 3 — Clear
Aug. 1 — Clear	Sept. 8 — Clear
Aug. 2 — Cloudy	Sept. 12 — Clear
Aug. 3 — Cloudy	

*Rainfall for Eufaula, Oklahoma

SUMMARY OF BOLL WEEVIL POISONING WORK IN 1931

(Hugo and Tishomingo)

Plot 1—Check, no poison.

Plot 2—Molasses mixture at weekly intervals throughout season.

Plot 3—Calcium arsenate after 10% infestation.

Hugo:	Yield in Pounds Seed Cot- ton Per Acre			Total Number Pois- of Applications		Total Lbs. or Gallons Poison Ap- plied Per Acre	
	Plot 1	Plot 2	Plot 3	Plot 2	Plot 3	Plot 2	Plot 3
Barrick, Cut C	1214	1206	1584	9**	8**	10.55a	49.43b
Brewer, Cut E	901	928	1435	6**	7	8.43a	44.69b
Brewer, Cut F	848		1532		8		47.49b
Russell, Cut G	498		794		8*		53.5 b

Tishomingo:							
Chapman, Cut A	648		1441		11		86.88b
Chapman, Cut B	535		1222		9		59.18b
Chapman, Cut C	501	690	972	9***	8	14.8a	57.2 b
Chapman, Cut D	652	774	811	6**	3	10.8a	24.1 b
Brashier, Cut E	792		905		8**		62.8 b

(Plot 1—Check, no poison)

(Plot 2—One pre-square application of molasses mixture

Porum: (followed by one application molasses mixture
seven days later

(Plot 3—One pre-square application molasses mixture followed by
calcium arsenate dust after 10% infestation,
except where noted.

Porum:	Yield in Pounds Seed Cotton Per Acre			Total Number Poison Applications		Total Lbs. or Gallons Poison Applied Per Acre	
	Plot 1	Plot 2	Plot 3	Plot 2	Plot 3	Plot 2	Plot 3
Hoos, Cut A§	1106		1429	3*	11**		61.9b
Hoos, Cut B	377	515	1002		9*	2.55a	54.9b
Hoos, Cut E§	906		1305		10***		61.0b

*One application poison rained off within 24 hours after being applied.

**Two applications poison rained off within 24 hours after being applied.

***Three applications poison rained off within 24 hours after being applied.

a—Gallons of molasses mixture.

b—Pounds of calcium arsenate dust.

1—No. pre-square applications of molasses mixture.

§—Plot 3 had no pre-square application of molasses mixture.

1932 RESULTS

Hugo:

Five cuts were located in Choctaw County, southeast of Hugo on bottom land along the Red River. The soil in Cuts A, B and C was a red, deep sandy loam while that in Cuts D and E was of an ash colored waxy texture. Favorable hibernation quarters for the boll weevil are numerous in the Red River bottom and the cotton plants on this fertile soil usually make a large vegetable growth which shades the ground well after July 10. This particular section of Oklahoma has suffered severe weevil damage during past years, especially in 1921, 1926 and 1932.

During 1932 cotton on soil such as Cuts A, B and C were located on, produced a very poor yield. The average check plot production for these three cuts was 443 pounds of seed cotton per acre, and this was several times more than the average for this type of soil in this locality. In 1932 there were 200 acres of cotton on the Russell farm and the total production was 18 bales. This type of soil is very fertile and will produce from 800 to 1500 pounds of cotton per acre when protected from weevil injury.

The average production on soils such as Cuts D and E were located on, was approximately 700 pounds of seed cotton per acre in 1932.

Cut A

This cut was located in the northwest portion of a 20 acre field which was bordered on the north by corn and cotton, on the east and south by alfalfa and on the west by corn. Woodland was $\frac{1}{4}$ mile distance to the north and west. This cut was located about $\frac{1}{4}$ mile southwest of Cut B and $\frac{5}{8}$ mile northwest of Cut C. This field was planted to pedigree Oklahoma 44 cotton about April 20, and was well worked throughout the season.

Cut B

This cut was located in the north portion of a 10 acre field which was bordered on the north by woodland, on the east and south by cotton and on the west by corn. This field was planted to Oklahoma 44 cotton during the latter days of April and received clean cultivation throughout the season.

Cut C

This cut was located in the north portion of a 10 acre field which was bordered on the north by a brushy fence row, on the east by truck crops, on the south by woodland and on the west by corn. This field was planted to Oklahoma 44 cotton during the last week of April and received very poor cultivation during the season. Weeds and tie vines were allowed to grow at random and by the end of the season they had practically concealed the cotton from view.

TABLE 6—BOLL WEEVIL CONTROL EXPERIMENTS AT HUGO, OKLAHOMA

Plot 1—Check, no poison.
 Plot 2—One pre-square application of molasses mixture (1-1-1) followed by applications of molasses mixture at 3 or 4 day intervals throughout the season.
 Plot 3—One pre-square application of molasses mixture (1-1-1) followed by molasses at weekly intervals throughout the season.
 Plot 4—One pre-square application of molasses mixture (1-1-1) followed by calcium arsenate after 10% infestation.
 Plot 5—Calcium arsenate dust after 10% infestation.

Plot No.	Yield in Lbs. Seed Cotton Per Acre	Total Lbs. Gallons Poison Applied Per Acre	Man Hours or Requir- ed Per A. Per Appli- cation	June 28	July 7	July 13	July 19	July 30	August 3	August 12
Russell, Cut A										
1	494			47 (11.3*) (2,7*)	77 (0.4)	82 (2)	83 (0.3,7)	94 (0)	95 (1) 93 (6)	
2	996	16.5a	1.1	6	26	35	70	89		
3	688	9.45a	1.0	19 (11,3*) (2,7*)	36 (0)	45 (2)	78 (3)	90 (0)	91 (6)	
4	1515	.96a 75.5b	1.3 1.0	26 (11) (3*,6*)	32 (0.4)	15 (2)	42 (2,7)	54 (1)	(1.5*,6,10) 48	
Russell, Cut B										
1	263			57 (11) (3*,6*)	76 (0.4)	84 (2)	88 (2,7)	92 (1)	92 (1.5*,6,10) 59	
4	956	1.11a 67.2b	1.18 1.0	29 (3*,6*)	51	37	45	66		
5	1086	73.3b	1.0	56 (3*,6*)	61 (0.4)	27 (2)	35 (2,7)	63	(1.5*,6,10) 36	
Norris, Cut C										
1	573			39 (10) (3*,6*)	40 (0.4)	74 (2)	90 (2,7)	91 (1)	(1,6)	
4	1737	.96a 53.4b	1.38 .87	10 (3*,6*)	16	37	59	45		
5	1167	55.7b	.87	46 (3*,6*)	14 (0.4)	44 (2)	60 (2,7)	57 (1)	(1,6)	
Nelson, Cut D										
1	675			6 (11,3*) (2,7*)	7 (0.1)	13	28	72		
3	569	6.1a	1.2	5	3	9	27	59		
4	772	.9a 20.4b	1.2 0.9	2 (11)	6 (1)	16 (0)	19 (0,6)	57		

a—Gallons molasses mixture per acre.

b—Pounds calcium arsenate dust applied per acre.

*—Rained off in 24 hours.

This field of cotton was located on a ridge that produced early growth. In 1931 the total production including all produced on the plots was less than 5,000 pounds of seed cotton. Due to the prospects of a low price for cotton and the heavy weevil infestation the tenant was discouraged and did not care to go to the trouble of giving it good cultivation. The small yield from this field in 1932 was practically caused by poor cultivation and largely by weevil damage.

INFORMATION SUPPLEMENTARY TO HUGO, OKLAHOMA, CUTS A, B, C, AND D

Plot No.	Average Height in Inches of 600 Plants on August 17				Number of Plants Per Acre on September 14			
	Russell Cut A	Russell Cut B	Norris Cut C	Nelson Cut D	Russell Cut A	Russell Cut B	Norris Cut C	Nelson Cut D
1	45.0	48.41	52.40	34.46	17,820	20,675	17,187	13,072
2	48.16			33.65	17,366			12,326
3	47.26				16,605			
4	48.24	42.58	54.45	37.76	16,995	22,882	17,743	11,942
5		44.28	47.47			21,160	20,692	

Climatological Data for Cuts A, B, C, and D

June 2 — .10 inch rain	July 20 — .50 inch rain
June 9 — 1.08 inches rain	July 21 — Cloudy
June 17 — Cloudy	July 22 — Clear
June 24 — 1.76 inches rain	July 24 — .30 inch rain
June 25 — .68 inch rain, partly cloudy	July 26 — Clear
June 26 — 1.53 inches rain	July 29 — Clear
June 27 — .71 inch rain	July 31 — Clear
June 30 — .25 inch rain, partly cloudy	Aug. 3 — Trace of rain
July 1 — Partly cloudy	Aug. 4 — Clear
July 3 — .20 inch rain	Aug. 8 — 1.30 inch rain, clear
July 4 — Cloudy	Aug. 9 — Cloudy
July 5 — 1.11 inch rain, cloudy	Aug. 13 — Cloudy
July 7 — Clear	Aug. 14 — .25 inch rain
July 8 — Cloudy	Aug. 18 — 1.62 inch rain
July 11 — Clear	Aug. 23 — Trace of rain
July 15 — Clear	Sept. 5 — .20 inch rain
	Sept. 13 — .10 inch rain
	Sept. 16 — 1.20 inch rain

Eufaula:

Eufaula is in McIntosh County, Oklahoma, about 20 miles north of latitude 35°, or slightly north of Memphis, Tennessee.

Five cuts were located in the vicinity of Eufaula; 4 of these were in McIntosh County, and the fifth was in Pittsburg County. This locality is approximately 20 miles due west of Porum where plot tests were conducted in 1929 and in 1931. The South Canadian River forms the southern boundry of McIntosh County and the northern boundry of Pittsburg County. The North Canadian River runs diagonally across McIntosh County and empties into the South Canadian River approximately 2 miles east of Eufaula. Deep Fork River traverses McIntosh County from the northwest corner and empties into the North Canadian River about 8 miles northwest of Eufaula. Along these rivers there is a large acreage of bottom land that is well adapted to cotton culture. Hibernation quarters for the boll weevil are fairly abundant in the timbered hillsides that border these bottoms. This section is about the extreme northern boundry in this state for heavy weevil damage. North of this section the weevil rarely ever causes heavy damage in any years.

In this locality the fields near the timbered hillsides suffered severe weevil

damage in 1932. Immediately west and north of the river bottom sections there are large areas of open prairie which rarely ever suffers any appreciable weevil damage. The average weevil population on the five cuts located at Eufaula in 1932 was 154 weevils per acre. These records were made on June 22-25 before treatments were started on the plots. At Hugo the weevil population averaged 392 per acre on June 17-18.

The soil in Cuts A, C, and E was very similar, being a light colored deep sandy loam river bottom. The soil in Cut D was very similar to that in Cut A, C, and E but was upland. Cut B was black sandy loam, creek bottom.

Cut A

This cut was located in the southeast section of a 160 acre field. This field was bordered on the east and south by corn and on the north and west by woodland. Woodland and brush growth were about $\frac{1}{4}$ mile distant to the east along the railroad. A cotton gin was located about 500 yards east of this field and immediately east of the cotton gin was a timbered hillside. During the fall of 1931 many bolleys were ginned there and thousands of weevils were thrown out with the burs and other trash. The timbered hillside near this gin was excellent hibernation quarters for the weevils that were concentrated in this area during the fall. This field was planted to Oklahoma 44 cotton on April 12 and received excellent cultivation throughout the season.

Cut B

This cut was located in an 80 acre field which was bordered on the north by a timbered hillside, on the east by cotton, on the south by cotton and corn, and on the west by woodland. This field was planted to Oklahoma 44 and Acala cotton from May 8 to 10. The cotton in the plots was Oklahoma 44 and the east side of the field was Acala. This farmer planted Oklahoma 44 cotton on the west side of the field as it is an earlier fruiting variety than the Acala. The western part of the field is surrounded by woods on two sides and is subject to heavier weevil infestation than the remainder of the field. This was one of the best fields of cotton in this locality in 1932. This 80 acre field produced 60 bales of cotton.

Cut C

This cut was located in a 12 acre field which was bordered on the north by corn, on the east and south by woodland and on the west by cotton. This field was planted to Acala cotton about April 22 and received clean cultivation throughout the season.

Cut D

This cut was located in the north portion of a 12 acre field which was bordered on the east by cotton, on the south by woodland, on the west by corn and on the north by bluffs with trees and heavy underbrush. The soil in this cut was a sandy loam upland. This field was planted to Sunshine cotton on May 8 and received 3 plowings and 1 hoeing. During the latter part of the season considerable weed growth was present among the cotton. This 12 acre field produced 10 bales of cotton in 1930 and the same in 1931, but in 1932 the production for the field did not average more than the check plot production which was 326 pounds of seed cotton per acre. An adjoining 30-acre field on this farm produced 13 bales in 1931 and only 2 bales in 1932.

Cut E

This cut was located in the west portion of a 10 acre field which was bordered on the north by a fence row, on the south by corn, on the east by woodland, and on the west by U. S. Highway 73 and the M. K. T. railroad. This field was located $\frac{1}{4}$ mile south of the cotton gin mentioned under the discussion of Cut A at Eufaula. This field was planted to Oklahoma 44 cotton on May 2 and received clean cultivation throughout the season.

TABLE 7—BOLL WEEVIL CONTROL EXPERIMENTS AT EUFAULA, OKLAHOMA

Plot 1—Check, no poison.

Plot 2—One pre-square application molasses mixture (1-1-1) followed by application of molasses at 3 or 4 day intervals throughout season.

Plot 3—One pre-square application of molasses mixture followed by weekly application of molasses mixture throughout season.

Plot 4—One pre-square application of molasses followed by calcium arsenate dust after 10% infestation.

Plot 5—Calcium arsenate after 10% infestation.

Plot No.	Yield in Lbs. Seed Cotton Per Acre	Total Lbs. or Gallons Poison Applied Per Acre	Man Hours Required Per A. Per Appli.	July 6	July 12	July 19	July 26	August 2	August 9	August 19	August 24
Gentry, Cut A											
Percent Weevil Infestation											
1	1113			16	35	45	53	84	94		
				(14.9)	(0.3)	(0.4)	(0.3)	(0.4*)	(0)		
2	1115	13.5a	1.2	6	19	41	51	79	93		
				(14.9)	(0)	(0)	(0)	(0)	(0)		
3	1178	8.52a	1.1	13	26	44	46	80	94		
		.94a		(14)	(2)	(1.6)	(3)	(4*)	(0.4)		
4	1331	46.2b	.8	15	23	34	21	37	67		
					(1.6)	(3)	(1.6)	(4*)	(0)		
5c	1450	36.0b	.8		46	39	29	52	72		
Turley, Cut B											
Percent Weevil Infestation											
1	1164			41	23	30	38	59			
				(14.9)	(1)	(0)	(0)	(0)			
3	1348	7.05a	1.2	23	16	19	26	37			
		1.04a	1.38	(14)	(2)	(1.6)	(1)				
4	1567	19.7b	0.9	35	19	7	10	11			
Blair, Cut C											
Percent Weevil Infestation											
1	750			20	35	47	56	84			
		1.23a	1.4	(13)	(8)	(2.6)	(3)				
4	859	28.4b	.65	18	22	13	11	26			
				(3)	(2.6)	(3)	(1)				
5	923	27.9b	.62	18	15	20	24	28			

a—Gallons of molasses mixture per acre.

b—Pounds of calcium arsenate dust used.

c—Calcium arsenate after 45.7% infestation.

INFORMATION SUPPLEMENTARY TO EUFAULA, OKLAHOMA, CUTS A, B, C, D, AND E

Plot No.	Average Height in Inches of 600 Plants on August 22					Number of Plants Per Acre On September 7				
	Gentry Cut A	Turley Cut B	Blair Cut C	Jennings Cut D	Wilson Cut E	Gentry Cut A	Turley Cut B	Blair Cut C	Jennings Cut D	Wilson Cut E
1	45.66	40.91	33.62	46.75	42.69	15,238	10,012	17,821	11,444	23,242
2	42.38									
3	45.13	40.01		36.89		14,556	10,235		13,073	
4	41.7	44.85	33.19	41.09	40.47	15,215	11,174	17,376	12,643	23,827
5	44.39		32.23		40.56	14,921		17,973		23,510

Climatological Data for Eufaula, Oklahoma, Cuts

A, B, C, D, and E

June 1 — 1.08 inches rain	July 3 — .48 inch rain	July 27 — Partly cloudy
June 4 — .06 inch rain	July 4 — .32 inch rain	July 28 — .07 inch rain
June 5 — .63 inch rain	July 6 — .97 inch rain, cloudy	July 30 — .81 inch rain
June 8 — 1.06 inch rain	July 7 — Clear	Aug. 1 — Clear
June 20 — .46 inch rain	July 8 — Clear	Aug. 2 — Partly cloudy
June 21 — .11 inch rain	July 9 — Clear	Aug. 6 — Clear
June 22 — Clear	July 12 — Partly cloudy	Aug. 9 — Partly cloudy
June 23 — Partly cloudy	July 13 — Partly cloudy	Aug. 13 — .11 inch rain
June 25 — .21 inch rain	July 14 — Clear	Aug. 16 — .06 inch rain
June 26 — 1.24 inches rain	July 18 — Clear	Aug. 17 — 3.5 inches rain
June 27 — .42 inch rain, partly cloudy	July 19 — Cloudy	Sept. 1 — 1.26 inches rain
	July 22 — Clear	Sept. 16 — .16 inch rain
June 29 — 3.22 inches rain	July 26 — Clear	Sept. 22 — .43 inch rain

SUMMARY OF BOLL WEEVIL POISONING WORK IN OKLAHOMA 1932

Plot 1—Check, no poison.

Plot 2—One pre-square application of molasses mixture (1-1-1) followed by application of molasses mixture at 3 or 4 day intervals throughout season.

Plot 3—One pre-square application of molasses mixture followed by molasses mixture at weekly intervals throughout the season.

Plot 4—One pre-square application of molasses mixture followed by calcium arsenate dust after 10% infestation.

Plot 5—Calcium arsenate dust after 10% infestation.

Hugo:	Yield in Pounds Seed Cotton Per Acre					Total Number Poison Applications Given					Total Lbs. or Gallons Poison Applied Per Acre				
	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 2	Plot 3	Plot 4	Plot 5	Plot 2	Plot 3	Plot 4	Plot 5	Plot 2	Plot 5
Russell, Cut A	494	996	688	1515		14**	9**	13***		16.5a	9.45a			96a	
Russell, Cut B	263			956	1086			13***	12***					75.6b	
Norris, Cut C	573													1.13a	73.3b
Nelson, Cut D	675			1737	1167			11**	10**					53.4b	55.7
			659	772			3**	3			6.14a			9a	

Bufala:

Gentry, Cut A	1113	1115	1178	1331	1450	13*	8	10*	7*	13.5a	8.52a			94a	36.0b
Turley, Cut B	1164		1343	1567			7	5			7.05a			1.04a	
Blair, Cut C	750			859	923			6	5					1.23a	27.9b
Wilson, Cut E	749			1614	1762			10*	9*					1.25a	43.6b

a—Gallons of molasses mixture.

b—Pounds of calcium arsenate dust.

*—One application of poison rained off within 24 hours after being applied.

**—Two applications of poison rained off within 24 hours after being applied.

***—Three applications of poison rained off within 24 hours after being applied.

§—Plot 3 had only two applications after pre-square.

1933 RESULTS

Eufaula:

During 1933 the investigations were confined to only one locality, Eufaula in McIntosh County.

Five cuts which included 13 plots were conducted at Eufaula, Cuts A and C were located on early planted cotton and Cuts D, E, and F were located on late planted cotton. The soil in all these plots was sandy loam river bottom.

The weevil infestation was so low throughout July that it was impossible to follow the original plans in these experiments and all plot tests conducted were for the purpose of determining the value of protecting bolls from weevil damage under conditions as existed in 1933.

In all poison applications the entire plot was treated as well as a buffer area extending at least 50 feet beyond each end. The acreage poisoned was determined for each plot separately and included the buffer areas.

Before picking each plot was carefully surveyed and the picking area staked out. The picking area was determined separately for each plot by actual measurement. The buffer areas at each end and from 5 to 6 rows on the outer edge of each plot were excluded from the picking area. The area used for picking records was surrounded by a margin of similarly treated cotton at least 20 feet in width. This procedure served to eliminate much of the effect of inter-plot movement of weevils. The areas selected for picking in each plot were carefully picked and weighed under the direction of some one familiar with the work.

Cut A

This cut was located in the west side of a 12 acre field which was bordered on the south by corn and on the other three sides by timbered hillsides. The population of over-wintered weevils in this field was greater than in any other field in this locality. This field was planted to Acala cotton on April 19 and received poor cultivation during the season. It was plowed only 3 or 4 times and hoed once.

Cut C

This cut was located in the northwest portion of a 110-acre field which was bordered on the north by cotton, on the west and east by corn and on the south by timber. The farm on which this cut was located is surrounded by an abundance of hibernation quarters for weevils and during some of the past years has suffered heavy weevil damages. In 1932, the average production was 250 pounds of seed cotton per acre but in 1933, a favorable year for cotton production and light weevil damage, the average production was 1300 pounds per acre. This field was planted to Acala cotton about April 24 and received clean cultivation throughout the season.

Two plots were treated with calcium for the purpose of protecting the young bolls after the weevils became numerous.

Cut D

This cut was located in a 4-acre field which was bordered on the east by cotton on the south by alfalfa, on the west by timbered bluffs along the north by the Canadian River and on the north by the farm house, barn and feed lots. This field was planted to Oklahoma Triumph 44 cotton on May 26. This field was planted to cotton earlier but a stand was not secured until the planting of May 26. This field received clean cultivation throughout the season.

Cut E

This cut was located in the southeastern portion of a 70 acre field. It was about one-fourth mile southeast of Cut D and one-fourth mile northwest of Cut F. This field had been planted to cotton on April 12-19 but a very poor stand was secured on the south side. The portion of the field in which this cut was located was planted three times before a stand was secured. The final planting was made on May 24. This field was of Oklahoma Triumph 44 variety and received clean cultivation throughout the season.

Cut F

This cut was located on the west side of an 80 acre field. This field was planted to Oklahoma Triumph 44 cotton during the latter part of April but a poor stand was secured on the portion where this cut was located. This part of the field was planted over on May 25. The field received clean cultivation throughout the season.

TABLE 8—BOLL WEEVIL CONTROL EXPERIMENTS AT EUFAULA, OKLAHOMA

Cuts A and C Were on Early Planted Cotton

Plot 1—Check, no poison.

Plot 2—Four applications of molasses mixture followed by calcium arsenate after 10% infestation.

Plot 3—One pre-sprout application of molasses mixture followed by calcium arsenate after 10% infestation.

Plot 4—Calcium arsenate after 10% infestation.

Plot No.	Yield in Lbs. Seed Cotton Per Acre	Total Lbs. or Gallons Poison Applied Per Acre	Man Hours Required Per A. Per Application	June 26	July 3	July 10	July 21	July 25	July 31	August 8	August 22
Turley, Cut A											
1	1144			5	0	1	9	10	13	69	
		4.2a	1.21	(6)	(0)						
2	1085	25.9b	.73	1	0	1	3	9	(4*,5)	(2,7)	
		.99a	1.32	(6)							
3	1233	24.3b	.7	5	2	4	5	7	(3*,4*,5)	(2,7)	
									14	23	
Goodlow, Cut C											
1	1673			1	.7	7	7	4	9	31	
4	1382	14.16	.73			2	1	4	6	(1,6,11)	25
4	2132	14.52	.78	1	3	4		3	2	(1,6,11)	26
										27	
Gentry, Cut D											
				Aug. 7	Aug. 17	Aug. 24	Aug. 30	Sept. 22			
1	1145			1	15	35	80				
					(2,5)		(0,5,10)				
4	1563	29.3	1.15	5	26	29	59				
Gentry, Cut E											
				Aug. 7	Aug. 18	Aug. 26	Aug. 30				
1	1142			.7	23	40	86				
					(2,5)	(5)	(5)				
4	1177	25.71b	.85	6	26	28	83				
					(2,5)		(0,5)				
4	1276	25.24b	.77	0	15	26	78				
Gentry, Cut F											
				Aug. 18	Aug. 26	Aug. 30					
1g	797			7	30	58					
					(1,4)	(0,5,10)					
4	858	36.55	.97	9	11	38					

a—Gallons molasses mixture used.

b—Pounds calcium arsenate used.

*—Rained off in 24 hours.

g—The check plot was given an application of 8.55 pounds calcium arsenate per acre on August 29 for leaf worm control.

INFORMATION SUPPLEMENTARY TO 1933 EUFAULA PLOTS A AND C, D, E AND F

Average Height of 600 Plants in Inches on August 22

Plot No.	Turley	Goodlow	Gentry		
	Cut A	Cut C	Cut D	Cut E	Cut F
1	31.71	38.26	57.63	45.36	55.04
2	22.83				
3	27.37				
4		38.52 36.09	56.58	42.06 42.25	56.25

Number of Plants Per Acre on September 29

Plot No.	Turley	Goodlow	Gentry		
	Cut A	Cut C1	Cut D3	Cut E	Cut F3
1	13,443	21,117	23,836	23,889	15,054
2	16,006				
3	14,546				
4		21,307 21,528	21,596	23,053 22,722	12,470

1. Plant counts taken on November 1.
2. Plant counts taken on October 23.
3. Plant counts taken on November 15.

Climatological Data at Eufaula, Oklahoma 1933 Boll Weevil Season

July 4 — .28 inch rain	Aug. 11 — Trace
July 12 — .58 inch rain	Aug. 12 — .13 inch rain
July 17 — 1.34 inches rain	Aug. 14 — Trace, cloudy
July 18 — .02 inch rain	Aug. 17 — .52 inch rain
July 19 — Partly cloudy	Aug. 18 — Trace
July 21 — .06 inch rain	Aug. 19 — Partly cloudy
July 22 — Partly cloudy	Aug. 20 — .02 inch rain
July 23 — .10 inch rain	Aug. 21 — .02 inch rain
July 24 — .11 inch rain	Aug. 22 — Trace, partly cloudy
July 25 — .07 inch rain	Aug. 24 — 2.29 inch rain
July 27 — Trace of rain	Aug. 25 — 1.03 inches rain
July 28 — Trace of rain	Aug. 26 — .03 inch rain
July 30 — .15 inch rain, partly cloudy	Aug. 27 — 1.19 inches rain
July 31 — .77 inch rain	Aug. 28 — .23 inch rain
Aug. 1 — 1.40 inch rain	Aug. 29 — .19 inch rain, cloudy
Aug. 2 — Trace	Aug. 30 — Partly cloudy
Aug. 3 — .17 inch rain	Sept. 2 — 5.66 inches rain
Aug. 4 — 2.02 inch rain	Sept. 3 — .34 inch rain
Aug. 5 — .06 inch rain	Sept. 4 — Clear
Aug. 6 — Trace rain	Sept. 9 — Clear
Aug. 8 — Trace rain	Sept. 10 — Clear
Aug. 9 — Partly cloudy	

SUMMARY OF BOLL WEEVIL POISON WORK AT SUFAULA, OKLAHOMA, 1933

Plot 1—(check, no poison.

Plot 2—Four applications molasses mixture followed by calcium arsenate after 10% infestation.

Plot 3—One pre-square application molasses mixture followed by calcium arsenate after 10% infestation.

Plot 4—Calcium arsenate after 10% infestation.

	Yield in Pounds Seed Cotton Per Acre			Total No. Poison Applications Given			Total Lbs. or Gals. Poison Per Acre Applied		
	Plot 1	Plot 2	Plot 3	Plot 4	Plot 2	Plot 3	Plot 4	Plot 2	Plot 3
Enfaula									
Turley, Cut A	1144	1085	1233		8*	6**	4.2a 25.9b	.99a 24.26b	
Goodlow, Cut C	1673			1382 2132			3 3		14.16b 14.52b
Gentry, Cut D	1145			1563			5		29.3b
Gentry, Cut E	1142			1177 1276			4 4		25.71 24.24
Gentry, Cut F	797			858			5		36.55

*—One application rained off within 24 hours after being applied.

**—Two applications rained off within 24 hours after being applied.

FAMILY LIVING ON POORER AND BETTER SOIL

By
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ABSTRACT

This study includes 250 farm families living on land in Noxubee, Oktibbeha, and Winston Counties, Mississippi, designated by the Land Policy Section of the A.A. as submarginal (poor soil) and 250 farm families living on land in the same counties designated by this section as suitable for resettlement (better soil). One-half of the group on each soil area were white families and one-half were negro families. The families on the better soil were selected so that their composition was similar to those on poorer soil.

About two-thirds of the white families and one-third of the negro families were landowners. Negro families on poorer soil were more frequently landowners than those on better soil, while white families on better soil were more frequently landowners than those on poorer soil.

The husbands and wives in white families on better soil had somewhat more schooling than those on poorer soil. It was the reverse in the case of negro families, those on poorer soil having had more schooling than those on better soil.

The white families in the study received during 1934 a gross cash income of about \$600, while the negro families received a gross cash income of about \$300. There was a greater difference in the gross cash income of white families on the two soil areas than of negro families, but in both cases the income of those on better soil exceeded that of those on poorer soil. White farm families on poorer soil netted only \$36.19 from their farm operation, negro families on poorer soil \$88.66, white families on better soil \$255.84, and negro families on better soil \$131.90. However, farming was a supplementary, not a main, occupation for quite a number of white farm families on poorer soil.

About 50 per cent of the total cash expenditures of the families in this study were family expenses, 40 per cent farm expenses and 10 per cent investments. White families on better soil spent \$313.06 for family living, while those on poorer soil spent \$197.61. Negro families on better soil spent \$184.75 for family living, while those on poorer soil spent \$150.84. White families on better soil produced more food at home and did more home sewing, while in the case of negro families it was the family on poor soil who produced more food and did more home sewing.

All family members, both white and negro, carried on varying farm and household tasks to some extent, although the heavier tasks were less often done by members of white families than of negro families and less often by members of the more prosperous than of the less prosperous families. Those on better soils more frequently did field work, for there were more field crops produced on such soils. Members of white families on better soil and negroes on poorer soil showed a greater diversity in the use of their leisure time than did the other two groups.

FAMILY LIVING ON POORER AND BETTER SOIL

By

DOROTHY DICKINS

INTRODUCTION

This study is based upon information concerning the incomes and the expenditures of 250 farm families living on poor soil and 250 farm families living on better soil in Oktibbeha, Noxubee, and Winston Counties, Mississippi, during 1934.¹ The purpose of the study is to find the amount of cash income received by these two groups, the different methods of spending this income, and other facts concerning their manner of living, such as activities engaged in by various members of the family, types of recreation, and relationships with community organizations. In other words, is there any difference in the way families on poorer and on better soil live?

METHODS OF STUDY

Communities in Oktibbeha, Noxubee, and Winston Counties designated as unsuitable for crop production and those suitable for crop production were visited during the winter and early spring of 1935, and the families in these communities were asked to cooperate by giving the information on questions concerning their manner of living.² Schedules were secured from 125 white families and 125 negro families on each type of soil area. The families on better soil were selected so that their composition was similar to those on poorer soil; that is, the families on poorer soil were visited first. They were classified as to their family composition, or as of adults only, of adults and children under 14 years, of adults and children 14 to 19 years, and of adults and children under and over 14 years. An equal number of schedules was then secured from families of each composition living on better soil.³ In the case of cropper and tenant families, the landlord as well as the family was interviewed, and, in most instances, the information given by the two checked fairly closely. This check was thought desirable in view of the fact that the crops are turned over to the landlord in a number of instances, and the non-owner knows little of the cash transactions. In fact, in many cases, his knowledge is limited to the amount received at settlement time. The information concerning the income and expenditures of the families covers the period from January, 1934, to January, 1935.

¹ The writer is indebted to the E. R. A. for interviewers and clerical workers, to Dr. Hazel K. Stiebeling of the Bureau of Home Economics for advice in the construction of the diet and food supply score cards, to Dr. F. Stuart Chapin of the University of Minnesota for suggestions for adapting his Social Status Scale for use in this study, to Dr. B. Youngblood of the Office of Experiment Stations, to Mr. Lewis E. Long of the Farm Security Administration, and to Mr. C. O. Henderson, also of the Farm Security Administration, for criticism of the manuscript.

² This was to have been the first part of a long time study of "The Effect upon Family Living of Moving from Submarginal to Resettlement Land." The submarginal and resettlement areas were originally selected by the Land Policy Section of the A. A. A., and it was on these areas that this study was made. Later, when the Resettlement Administration took it over, new areas were designated. The data collected, however, do picture the manner of living of two groups homogenous as to composition—one group residing on areas not as suitable for crop production as the areas on which the other group resides. In view of the importance of soil fertility to the income of the farm family, and of income to the welfare of the family, it seems worthwhile to report the material thus obtained.

A DESCRIPTION OF THE 500 FARM FAMILIES

Most of the white families included in the study were from Winston County, as there were more white families on the areas selected for study in Winston County than in Noxubee and Oktibbeha Counties. This was not true of negro families. There were about the same number of negro families on these areas in the three counties (Table 1)⁴. The families in the study were somewhat larger than the typical farm family in the county. This may be partly due to the fact that no one-person families were included. The farms operated by the families of the study were slightly larger than those operated by the typical farm family in the county. This is due to the fact that larger families operate larger farms and also to the inclusion of an equal number of negroes and whites. White families operate larger farms than do negro families. This study, therefore, does not purport to picture the manner of living of farm families of Noxubee, Oktibbeha, and Winston Counties, but of the manner of living of a selected sample of white and negro families on poorer and better soil in these counties.

Table 1—White and Negro Families on Poorer and Better Soil from Whom Schedules Were Obtained Classified by County of Residence

Counties	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Number	Number	Number	Number
Noxubee	8	8	41	41
Oktibbeha	5	5	47	47
Winston	112	112	37	37
Total	125	125	125	125

The main source of income of the majority of families in the study, both white and negro, was from the farm, and the main crop of the farm was cotton. The families on poorer soil areas, however, more frequently obtained their main income from work off the farm than the families on better soil areas. This was more often true of white families than of negro families, doubtless due to the fact that white families have more influence and can thus more easily secure the little non-farm work which is available. Non-farm work in the poorer soil areas was, for the most part, in the lumbering industry. Indeed, the poorer soil areas are more suited to the production of forest crops than to production of cotton. Nearly one-fifth of the families on these areas did not even attempt to produce cotton (Table IV). Of those who did, 84 per cent did not produce over 200 pounds of lint per acre.

It is important to know not only how the families on the two areas made their living, but also their relationship to the land—the proportion who were owners, renters, and croppers. The fact that about two-thirds of the white families owned their farms is doubtless due to the fact that most of the white families lived in

3Family Composition of White and Negro Families on the Two Areas.

Family composition	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Number	Number	Number	Number
Adults only	31	31	28	28
Adults and children under 14 years.....	52	52	40	40
Adults and children 14 to 19 years.....	12	12	10	10
Adults and children under and over 14 years.....	30	30	47	47
Total	125	125	125	125

⁴The 1935 Agricultural Census shows 810 farms in Noxubee County, 1203 in Oktibbeha County, and 2201 in Winston County operated by white men and 8901 farms in Noxubee County, 2299 in Oktibbeha County and 1199 in Winston County operated by negro men.

Table 2—Main Source of Income of Families Living on Poorer and Better Soils—1934

Main source of income	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Number	Number	Number	Number
From farm operated	79	105	105	110
Other	46	20	20	15
Farm laborer	2	1	3	9
Driver and carrier	9	5	1	1
Professional service	1	1	4	1
Cash payments from children and others	2	..	2	2
Common labor	15	7	8	2
Pension	6	5	1	..
Domestic and personal service	..	..	1	..
Boarders	2	1	..	..
Direct relief	1	..	..	..
Machine and related trades	3	..	..	..
Proprietor and manager	1	..	..	..
Inheritance	1	..	..	..
Sale of timber	2	..	..	..
Factory operator and laborer	1	..	..	..
Total	125	125	125	125

Table 3—Main Cash Crop of Those Families Living on Poorer and Better Soil Who Derived Principal Source of Income from Their Farms—1934

Main cash crop	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Number	Number	Number	Number
Cotton	62	99	101	104
Dairying	3	5	2	6
Corn	7	..	1	..
Livestock	3	..	1	..
Poultry	3	..	..	..
Syrup	..	1	..	..
Vegetables	1	..	..	..
Total	79	105	105	110

Table 4—Pounds of Lint Cotton per Acre Made by Families on Poorer and Better Soil—1934

Pounds of lint cotton per acre	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Number	Number	Number	Number
No cotton	34	5	9	6
100 pounds and under	28	5	46	16
101-200 pounds	45	50	55	47
201-300 pounds	16	41	13	48
301-400 pounds	2	20	2	7
401-500 pounds	..	4	..	1
Total	125	125	125	125

Winston County, where the average value of farms (land and buildings) per acre was less,⁵ and the initial payment on a farm consequently less. White families on the more fertile soil and negroes on the less fertile soil were more often landowners. Negroes, as a rule, buy land which white people find unprofitable to rent out and,

⁵In 1935 the average value of farms per acre in Oktibbeha County was \$15.74, in Noxubee County \$14.03, and in Winston County \$11.03. U. S. Bureau of the Census, *Census of Agriculture, 1935*, Mississippi, pp. 11, 13.

for one reason or another, do not farm themselves. There are several reasons for this, one of them being that, as a rule, negroes have little capital and the poorer land is the only land they can buy. That there were more landowners among whites on better land may be due to the fact that more than one-third of the white families on poorer lands derived the main source of their income from work off the farm, or made of farming a supplementary occupation. The cropper on poor soil often raised no cotton, but paid his rent in corn and potatoes and earned his cash from work off the farm. Families on poor soil are frequently allowed to remain on farms without payment in cash or kind.⁶

Table 5—Tenure of Families Living on Poorer and Better Soil—1934

Farm tenure	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Number	Number	Number	Number
Owners	76	91	53	18
Croppers	26	14	36	66
All other tenants	14	18	34	40
Pay no rent	9	2	1	—
Total	125	125	124*	124**

*One family did no farming

**The head of one family was a farm laborer

The farmers in this study were small scale farmers. About three-fourths of them had 25 acres or less in cultivation. Families on better soil, both white and negro, cultivated more land, though they generally owned smaller farms than those on poorer soil. That families on poorer farms cultivated less land is due to the fact that a smaller proportion of land on poor soils is worth cultivating and that there are, as a rule, poorer farmers on poorer soil.

What was the occupational background of the farm operators and homemakers of this study? How many had always farmed? What proportion had had non-farm experience? How did those on the two areas differ in this respect? About two-thirds of the operators had farmed ever since leaving school. Only one-third had had non-farm experience. The most frequent kind of non-farm work which these had engaged in was sawmilling, truck driving and common labor. Only 17 had done skilled, clerical, or professional work. The proportion of homemakers having had experience in work off the farm was about half of that of farm operators. Most of the homemakers having had such experience were negro women. Only 35 of the white homemakers had worked off the farm since leaving school. White and negro operators on the poorer soil had had somewhat more varied occupational experience than those on better soil, while the white and negro homemakers on better soil had had somewhat more varied occupational experience than those on poorer soil. The white farm homemakers on the better soil had had more schooling than those on the poorer soil. A number of them had taught; several had been salesladies. The difference in the number of negro farm homemakers with gainful employment history on the two areas is due to the fact that the better soil offers more opportunity to engage in domestic service. About 29 per cent of the negro homemakers on the better soil had engaged in this work, while only 17 per cent on the poorer soil had done so.

Fifty-three of the 500 families included in the study were broken. There were more broken families on poorer soil than on better soil and more broken negro families than white families.⁷ Normal families, of course, are more likely to migrate from poorer areas; broken families generally have less bargaining power.

⁶Those who paid the taxes for use of land were, of course, classified as cash renters.

⁷There are more widowed and divorced negroes on Mississippi farms than there are widowed and divorced whites.

Then, too, friends or relatives often rent very cheaply or even loan without charge a small submarginal farm to the widow with children, the most common type of broken family. It is interesting to note that white and negro families on poorer soil had more grandchildren living with them than those on better soil. This seems to indicate that their sons and daughters had met with greater misfortune than

Table 6—Members of the Household of White and Negro Families Living on Poorer and Better Soil

Members of household*	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Number	Number	Number	Number
Husbands	114	122	110	114
Wives	115	125	119	122
Sons	143	177	146	165
Daughters	136	162	176	174
Husband's mother	4	3	2	6
Husband's father	5	1	2	..
Wife's mother	4	5	3	7
Wife's father	..	1	..	2
Grandchildren	13	6	40	29
Sisters of husbands and wives	..	1	2	7
Brothers of husbands and wives	1	2	1	6
Daughters-in-law	1	1	4	4
Sons-in-law	..	1	2	..
Others	3	1	20	18
Total	539	608	627	654

*Those who spent a part of each year at home.

the sons and daughters of families on better areas. Negro families on both areas had a number of "other" persons living in the family, such as orphan children, nieces or nephews, or friends. This is doubtless due to the fact that there are few institutions for the care of homeless negro children.

Table 7—Size of White and Negro Families* Living on Poorer and Better Soil Areas

Size of family	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Number	Number	Number	Number
2- 2.9 members	24	18	24	19
3- 3.9 members	33	23	22	22
4- 4.9 members	24	23	24	20
5- 5.9 members	16	24	11	18
6- 6.9 members	10	15	13	12
7- 7.9 members	7	5	12	11
8- 8.9 members	1	7	5	2
9- 9.9 members	4	7	1	9
10-10.9 members	4	2	6	6
11-11.9 members	..	1	1	2
12-12.9 members	..	..	3	..
13-13.9 members	2	..	2	3
14-14.9 members	1	..	1	1
Total	125	125	125	125
Average size	4.3	4.3	4.9	5.3

*A family in this study is defined as a group of persons usually related either by blood or marriage or adoption, living together as one household, generally sharing the same table. Those living in the family during 1934 counted as 1 person; those in the family 4 months during this period as .3 person.

Even though there were the same number of white and negro families on poorer and better soil with adults only, adults and children under 14 years, adults and

children 14 to 19 years, and adults and children under and over 14 years, the size of the families on the two areas varied somewhat; the families on the more productive areas contained about .5 more members (Table 7) than those on the less productive areas. In fact, it took some searching to find in the better soil communities the same number of families of adults only as found in the poorer soil communities. Some of the larger families with growing children had probably moved from the poorer to the better soil. However, in any comparison of the expenditures of two or more groups of families, the ages of the members in the various groups as well as their actual number of members is important, for the requirements of persons of different ages are different. By selecting families on the better soils to correspond in presence or absence of children under 14 years and from 14 to 19 years, the proportion of families with members of different ages was similar. Seventy-one per cent of the negro wives on poorer soil and 77 per cent on better soil were less than 50 years of age. There was about the same proportion of sons and daughters under 6 years, 6-13 years, 14-18 years, and 19 years and over in the families on the two areas.

Table 8—Formal Education of Husbands and Wives in the White and Negro Families on the Poorer and Better Soil

Schooling of fathers and mothers	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Number	Number	Number	Number
Both no schooling	..	..	4	5
Both less than 4th grade	3	1	10	17
Mother 4th-9th, father less	7	2	30	31
Father 4th-9th, mother less	1	2	9	6
Both 4th-9th	55	53	43	42
Father high school, mother less	4	9	3	2
Mother high school, father less	22	23	2	7
Both high school	17	19	..	1
Father college, mother less	..	4	1	..
Mother college, father less	1	4	1	..
Both college	..	5	..	..
Information not secured	..	..	1	..
Total	110	122	104	111

Table 9—Formal Education Score per Family of Members 19 Years and Over of Families on Poorer and Better Soil

Formal education score*	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Per cent	Per cent	Per cent	Per cent
0	..	..	5.0	2.4
1 or less	24.8	16.8	66.2	74.4
1.1 to 2	33.6	30.0	24.3	20.0
2.1 to 3	36.8	32.4	3.0	1.6
3.1 to 4	4.8	16.0	1.5	1.6
4.1 and over	..	4.8	..	..
Total	100.0	100.0	100.0	100.0

*Rating scale for education accomplishments: attended college 5.0; high school graduate 4.0; attended high school 3.0; 8th grade graduate 2.0; attended grammar school 1.0; no schooling 0. (Missouri Agricultural Experiment Station Bulletin No. 148, p. 30).

As may be noted (Table 8), the husbands and wives in white families on better soil had somewhat more schooling than husbands and wives on poorer soil. It

was the reverse in the case of negro families, those on poorer soil having had more schooling than those on better soil. A tabulation in Table 9 of the education scores of the adults in these families gives similar results. The fact that nearly one-half of the negro families on poorer soil were landowners may account for this. Without doubt, the negro families on poorer soil were somewhat superior to those on better soil.

CASH INCOME

The white families in this study received during 1934 a gross cash income of about \$600, while the negro families received a gross cash income of about \$300. There was a greater difference in the cash income of white families on the two soil areas than of negro families, but in both cases the gross cash income of those on better soil exceeded those on poorer soil (Table 10). Gross cash income in this study is defined as total cash realized from the sale of all the farm products produced plus the cash income received from other sources than the farm. Thus the cash value of the cotton which the cropper pays the landlord as rent is included as a part of the cropper's gross income. In other words, in this study the landlord's half of the crop is looked upon as a farm expense of the cropper, and the cropper's half of the crop as a farm expense of the landowner. Even though cash does not enter into the transaction, cash products do.

Table 10—Source of Cash Income per Family of White and Negro Families Living on Poorer and Better Soil—1934

	White families				Negro families			
	Poorer soil		Better soil		Poorer soil		Better soil	
	Dollars	Per cent	Dollars	Per cent	Dollars	Per cent	Dollars	Per cent
Sale of crops*	118.30	32.7	455.88	55.8	137.76	49.6	254.58	68.8
Sale of livestock	18.74	5.2	40.48	5.0	7.40	2.7	6.73	1.8
Sale of fruits and vegetables	8.63	1.0	17.14	2.1	.67	.2	.22	.1
Sale of forest products	9.11	2.5	.85	.1	8.86	3.2	.61	.2
Sale of livestock products	14.88	4.1	121.06	14.8	46.26	16.6	41.35	11.2
Total sale of farm products	164.66	45.5	635.41	77.8	200.95	72.3	303.49	82.1
A.A.A. benefit and rental payments								
—Sale of certificates	23.43	6.5	44.83	5.5	6.08	2.2	7.40	1.9
Farm labor	1.64	.4	1.01	.1	4.94	1.8	26.52	7.2
Total from farm and farm work	189.73	52.4	681.25	83.4	211.97	76.3	337.41	91.2
Non-farm work (non-relief)	64.78	17.9	46.52	5.7	12.77	4.6	6.47	1.7
Work relief	9.19	2.5	14.89	1.8	1.90	.7	1.67	.6
Pensions	20.64	5.7	27.12	3.3	2.88	1.0	.48	.1
Gifts in cash for current use from								
persons not a family member	.86	.3	1.36	.2	2.21	.8	3.76	1.0
Boarders	2.88	.8	4.13	.5	.45	.2	.74	.2
Other receipts	8.19	2.3	6.32	.8	1.93	.7	.39	.1
Total	296.27	81.9	781.59	95.7	234.11	84.3	350.92	94.9
Amount owed or borrowed								
for current use	47.23	13.1	32.64	4.0	41.41	14.9	18.90	5.1
Capital used from previous years	18.40	5.0	2.20	.3	2.32	.8	....	..
Total receipts	361.90	100.0	816.43	100.0	277.84	100.0	369.82	100.0

*Includes sale of field crops.

All four groups obtained the largest part of their gross income from the sale of farm products (Table 10). However, only one-half of the white families on poorer soil derived more than 50 per cent of their incomes from the sale of farm products (Table 11). Ninety per cent of the white families on better soil and 85 per cent of the negro families on this soil obtained this amount of their cash income from farm products. Indeed a high percentage of one's cash income from

the sale of farm products seems to be one of the characteristics of the cash incomes of families on better soil. Negro families on poorer soil were not able to supplement the inadequate cash incomes realized from their farms with earnings from labor off the farm to the extent that white families were.

Though more white families on the less productive soil had work relief during the schedule year (34 families) than those on the more productive soil (27 families), the amount received per family by white families on the more productive soil areas was greater (Table 10). This was due to the fact that more of those with work relief on the more productive soil were rated as skilled and professional workers than those on the less productive soil. More negro families on the poor soil areas (17 families) likewise received relief than those on better soil areas (15 families). Though the proportion of families receiving work relief during the schedule year was not great, over one-half of the families included in this study had received relief at some time during their history, many of these during the operation of the C.W.A. More families on poorer soil than on better soil had a relief history.^a

Table 11—Percentage Distribution of Cash Income From Sale of Farm Products of White and Negro Families on Poorer and Better Soil

Percentage distribution of cash income from farm products	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Number	Number	Number	Number
25 or less	36	5	14	7
25.1 to 50	24	9	20	11
50.1 to 75	28	25	30	14
75.1 and over	37	86	61	93
Total	125	125	125	125

Quite a few of the families purchased goods and services on credit during the schedule year (Table 10). A few borrowed money to pay for such goods and services. In some cases cash was drawn from a savings account or property sold to meet current expenses. This practice was more common among families on the poorer areas. Though credit or cash from such sources cannot in one sense be considered as a part of the yearly income, for all purposes of this study it can. The families used this credit or cash to purchase goods and services during the schedule year. If it is left out, then a one-sided picture of the family finances is given.

Table 12—Percentage Distribution of White and Negro Families on Poorer and Better Soil According to Total Cash Income

Total cash income groups	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Per cent	Per cent	Per cent	Per cent
\$ 100 and under	15.2	.8	17.6	5.6
\$ 100.01 to \$ 200	41.6	8.0	35.2	21.6
\$ 200.01 to \$ 300	15.2	20.0	17.6	27.2
\$ 300.01 to \$ 400	4.8	16.0	8.8	13.6
\$ 400.01 to \$ 500	8.8	8.8	8.0	8.0
\$ 500.01 to \$ 750	3.2	14.4	8.8	13.6
\$ 750.01 to \$1000	4.0	7.2	1.6	8.0
\$1000.01 and over	7.2	24.8	2.4	2.4
Total	100.0	100.0	100.0	100.0

It is important to know not only the income of the white and negro families on these two areas, but also how these incomes were distributed. How many white

^aThis information was verified from records on file in the county welfare offices. Since this study, all families living on submarginal land purchased by the government and not yet resettled have been given work relief.

families on poor soil made more than \$300 and how many less than \$300? As may be noted (Table 12), nearly three-fourths of the white families on poor soil made less than \$300, while only one-third of those on better soil had incomes as low. The variation in the incomes of negro families on the two soil areas was not as great as that of white families. The cash income of nearly one-fourth of the white families on better soil exceeded \$1000. Three families made over \$4000, the highest income being \$5155.

During the schedule year, the husbands of the white families on poorer soil earned more from labor off the farm than did those on better soil, while in the case of the wives, sons, and daughters it was the reverse. All members of negro

Table 13—Members of White and Negro Families on the Poorer and Better Soil Areas Contributing to the Cash Family Income by Labor Off the Farm*

Members	White families				Negro families			
	Poorer soil		Better soil		Poorer soil		Better soil	
	Earnings per family	Total number earning	Earnings per family	Total number earning	Earnings per family	Total number earning	Earnings per family	Total number earning
Husbands	\$65.29	48	\$41.88	42	\$15.54	48	\$21.56	60
Wives	5.93	9	6.63	10	1.95	15	3.80	15
Sons	4.90	13	11.39	7	3.25	9	6.57	14
Daughters	1.80	3	6.36	6	1.66	8	13.49	5
Total	\$77.92	73	\$66.26	65	\$22.40	80	\$35.42	94

*Includes all work done off the farm for cash, farm work, as well as non-farm work.

families on better soil earned more from labor off the farm than did those on poorer soil (Table 13). Evidently there is less work available for women and children on poor soil. Most of the non-farm work available on such soil is in the sawmilling industry, which industry generally employs white men. Then, too, there may be less desire on the part of women and girls on poor soil for work off the farm.

Table 14—Gross Value of Farm Products Produced by White and Negro Homemakers on Poorer and Better Soil

Products sold	White families				Negro families			
	Poorer soil		Better soil		Poorer soil		Better soil	
	No. home- makers	Av. amt. per no. contrib.	No. home- makers	Av. amt. per no. contrib.	No. home- makers	Av. amt. per no. contrib.	No. home- makers	Av. amt. per no. contrib.
Poultry and poultry products	39	\$ 8.72	56	\$11.72	48	\$ 5.25	35	\$12.24
Dairy products	4	23.27	6	5.58	5	25.60	5	170.80
Dairy and poultry products	10	28.06	11	83.04	10	91.10	3	58.59
Poultry and livestock products ....	.....	.....	.....	.....	.....	.....	2	25.01
Fruits and vegetables	1	9.00	.....	.....	1	.35	1	3.00
Poultry, dairy products and fruits and vegetables .....	.....	.....	.....	.....	2	29.73	1	8.90
Poultry and fruits and vegetables	1	23.80	3	13.83	.....	.....	2	18.40
Fruits and vegetables and livestock products .....	.....	.....	.....	.....	.....	.....	1	4.00
Poultry, dairy products and potatoes	1	36.50	.....	.....	.....	.....	.....	.....
Dairy products and livestock....	1	21.00	.....	.....	.....	.....	.....	.....
Total	57	\$150.35	76	\$114.17	66	\$152.08	50	\$295.94

More of the homemakers in white families on the better soil produced foods for sale, as well as found work off the farm. However, the homemakers on poor soil who did raise food products for sale realized a greater amount. The situation is the reverse in the case of negro homemakers. More on poorer soil sold food products, but the value of the products sold by those on better soil was greater. The number producing any farm products for sale except poultry and poultry products, however, was negligible. Indeed, the sale of poultry and poultry products seems to be about the only way most of the farm homemakers had of supplementing the family income. Production of poultry and poultry products for sale was more common in the groups where there were more landowning families.

CASH EXPENDITURES

Table 15 shows that during the schedule year (1934) the white families on poorer soil spent a total of about \$390, those on better soil \$769, and that the negro families on poorer soil spent \$278 and those on better soil \$376. The families on better soil spent more in actual dollars and cents for family living than did those on poorer soil, but relatively less (Table 15). The farmer on poor soil must use a greater proportion of his income for family living. His income is low because so little is spent on the farm. So little is spent on the farm because his income is low.

Just as the cash incomes of families on better soil are characterized by the large proportion of the income derived from the sale of farm products, so their cash expenditures are characterized by the relatively large farm expense. About 50 per cent of the total expenditures of white families and 46 per cent of the total ex-

Table 15—Cash Expenditures Per Family of White and Negro Families Living on Poorer and Better Soil—1934

Cash expenditures	White families				Negro families			
	Poorer soil		Better soil		Poorer soil		Better soil	
	Dollars	Per cent	Dollars	Per cent	Dollars	Per cent	Dollars	Per cent
Farm expense	128.47	33.0	379.57	49.3	111.29	40.0	171.56	45.6
Crop expense	43.60	11.2	212.80	27.7	28.48	10.2	34.90	9.3
Livestock expense	7.32	1.9	41.54	5.4	14.23	5.1	8.13	2.2
Fruit and vegetable expense	1.29	.3	1.87	*	.58	.3	.64	.1
Working equipment expense	27.12	7.0	38.44	5.0	8.88	3.2	12.90	3.4
General expense	49.14	12.6	84.92	11.0	59.12	21.3	114.99	30.6
Family expense	197.61	50.7	313.06	40.7	150.84	54.3	184.75	49.1
Food expense	62.88	16.1	91.09	11.8	55.16	19.8	79.20	21.1
Clothing expense	50.72	13.0	82.36	10.7	43.67	15.8	53.12	14.1
Furniture and furnishings	5.58	1.4	12.93	1.7	2.91	1.0	5.41	1.4
Other housekeeping expense	7.29	1.9	20.82	2.7	4.41	1.6	6.45	1.7
Personal expense	8.31	2.1	13.07	1.7	7.03	2.5	9.25	2.5
Housing expense***	7.46	1.9	8.15	1.1	.36	.1	.03	*
Miscellaneous expense	42.35	10.9	69.00	9.0	27.00	9.8	19.75	5.2
Back debts on family living paid	13.02	3.4	15.74	2.0	10.30	3.7	11.54	3.1
Investments	63.70	16.3	76.53	10.0	15.84	5.7	19.60	5.3
Reinvestments in farm business	7.67	2.0	21.40	2.8	7.68	2.8	4.37	1.1
Insurance	6.27	1.6	10.53	1.4	1.58	.6	1.61	.4
Payments on mortgages	14.53	3.7	25.83	3.4	6.10	2.2	13.02	3.5
All other investments	35.18**	9.0	13.72	2.4	.48	.1	.60	.2
Total	\$39.78	100.0	769.16	100.0	277.97	100.0	375.91	100.0

*Less than .05 per cent

**One family loaned \$3000. Excluding this loan would make an average of \$9.18 per family.

***All rent and taxes were accounted as farm expenses. It is a characteristic of the farm business that it must bear the overhead of a livable house. Housing expenses include repairs, replacement, insurance, and lodging away from home.

penditures of negro families, on better soil, was spent for the farm. The farm expenses of white families on poorer soil amounted to only one-third of their total expenditures. This was, of course, partly due to the fact that a number of white families on these poorer areas did very little farming and depended in large part for their livelihood upon non-farm work. Crop expenses included expenses for fertilizer, seed, ginning, and day and cropper labor. The fact that white families on better soil had more labor expense than those on poorer soil explains their relatively high crop expense, in which category such farm expenses were classed. General expenses included, in the case of shareworkers, the value of the landlord's part of the crop; in the cash renters, the cash rent; and, in the case of land owners, the taxes. Interest on money borrowed for the farm business, insurance, repairs, and fencing were other items included as general farm expense.

White farmers on poorer soil netted only \$36.19 from their farm operation during the schedule year (Table 16). Many of the farmers on the less productive soil areas lost money farming. The X family, for example, of five members, two sons, 14 and 11 years of age, and a daughter, 9 years of age, sold 230 pounds of lint cotton. Their farm expense was as follows: \$10 for fertilizer, \$40 for feed, \$1.50 for garden seed and \$24.50 for taxes. The taxes were unpaid. Of course, some of the families like X have a supplementary occupation. However, some do not. Such families live in poverty. As would be expected, white and negro farmers on better soil cleared more on their farms than did farmers on poorer soil.

Table 16—Gross Cash Receipts, Cash Expenditures and Net Cash Receipts From Farming of White and Negro Families on Poorer and Better Soil—1934

Item	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Dollars	Dollars	Dollars	Dollars
Gross cash receipts	164.66	635.41	200.95	303.49
Cash expenditures	128.47	379.57	111.29	171.56
Net cash receipts	36.19	255.84	88.66	131.93

Expenditures for family living during 1934 amounted to less than \$200 per family for all groups except white families on better soil (Table 15).⁹ These families averaged \$313. About 30 per cent of the total expenditure for family living of white families and 40 per cent for negro families went for food. Twenty-six per cent of the amount spent by white families on family living was spent for clothing, while 29 per cent of the amount spent by negro families for these items was spent for clothing. There was no difference in the proportion spent for clothing by families on the two soil areas. However, there was a difference in the case of food expenditures of negro families on the two soil areas. Relatively more was spent for food by negro families (about 6 per cent more) on the more productive areas. Negro families on poorer areas spent relatively less on food in order that they might spend relatively more on miscellaneous items, such as medical care, papers and magazines, formal education, recreation and auto, gifts and contributions, or items usually judged as indicating a high standard of living. They spent 18 per cent on such items, while negro families on better soil spent only 11 per cent.¹⁰

⁹Back debts on family living paid were included as a family expense. They might have been classified as an investment. However, back farm debts paid, as taxes, seed loans, were classified as farm expenses.

¹⁰Negro families on poorer soil spent absolutely as well as relatively more for medical care than those on better soil. One hundred and one negro families on poorer soil averaged \$15.70 for sickness and death and 99 negro families on better soil averaged \$9.74 for these items; or to express it relatively, 10 percent of the family expense of the negroes on poor soil went for sickness and death, while only 7 per cent of the family expense of the negroes on better soil went for these expenditures.

Table 17—Percentage That Family Expenses Were of Total Expenses of Families on Poorer and Better Soil

Per cent that family expenses were of total expenses	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Per cent	Per cent	Per cent	Per cent
Less than 30 per cent	4.8	12.0	7.2	8.8
30-49.9 per cent	6.4	32.8	19.2	33.6
50-74.9 per cent	45.6	41.6	50.4	44.0
75 per cent and over	43.2	13.6	23.2	13.6
Total	100.0	100.0	100.0	100.0

The families in this study, both white and negro, on poorer or better soil areas spent little for investments. The amount thus spent by negroes was almost negligible, and this was, in most cases, spent for payment on mortgage principal. The insurance carried by negro families in this study was altogether burial insurance. Seventeen white families on the poorer soil areas and 55 on the better soil areas carried burial insurance, while 43 negro families on the poorer soil areas and 47 on the better soil areas carried this insurance. Reinvestments in farm business included expenditures for additions or new buildings, equipment, and livestock purchased during the schedule year. Negro families on poorer soil had a greater expenditure for these items than those on better soil. However, there were more landowners on poorer soil.

In this study no attempt was made to make the cash receipts and cash expenditures balance. In fact, the schedules were not set up with this in view. However, every schedule was carefully checked over with the field agent, and, where there seemed to be inconsistencies, the agent was requested to revisit the family for further questioning. Even though no attempt was made to balance the receipts and expenditures there was little difference between them (Table 18), the difference for the group as a whole being less than 4 per cent. There was a greater discrepancy in the receipts and expenditures of white families than of negro families. Low income families are more likely to overstate their expenditures or understate their income, while high income families are more likely to overstate their income or understate their expenditures. The cash receipts and expenditures of 40 per cent of the families in this study balanced within 10 per cent. In 40 per cent of the schedules the cash expenditures were more than 10 per cent greater than the cash receipts, while in 20 per cent of the schedules the cash receipts were more than 10 per cent greater than the cash expenditures. There were, of course, many low income families in this study, and this doubtless explains why the cash expenditures were, on the whole, greater than the cash receipts.¹¹

Table 18—Total Cash Receipts, Cash Expenditures and Difference in Cash Receipts and Cash Expenditures of White and Negro Families on Poorer and Better Soil—1934

Item	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Dollars	Dollars	Dollars	Dollars
Cash receipts	361.90	816.43	277.84	369.82
Cash expenditures	389.73	769.16	277.97	375.91
Difference in cash receipts and cash expenditures	27.83—	47.27+	.13—	6.09—

FOOD AND STIMULANTS

About one-fifth of the total cash expenditures of negro families and one-seventh of the total cash expenditures of white families went for food, families on the poorer soil spending a larger proportion than those on better soil. Very little was spent by either group for food away from home (Table 19). That the majority of families

in this study (Table 20) could manage on as little as \$25 to \$50 cash for food during a year was, of course, due to the fact that these expenditures were supplemented by foods raised at home, by fish and game, and by nuts secured from nearby wooded areas.

Though the average cash expenditure for food by white families on the two areas was somewhat greater than that by negro families, there were more negro families spending over \$75 for food than there were white families (Table 20). Twenty-six per cent of the white families on poorer soil areas and 30 per cent of

Table 19—Expenditures for Food at Home and Away From Home by White and Negro Families on Poorer and Better Soil

Item	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Dollars	Dollars	Dollars	Dollars
At home	61.27	87.27	53.41	77.46
Away from home	1.61	3.82	1.75	1.74
Total	62.88	91.09	55.16	79.20

Table 20—Variation in Food Expenses of Whites and Negroes on Poorer and Better Soil

Variation in food expense per year	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Per cent	Per cent	Per cent	Per cent
\$ 25 and under	20.0	8.0	11.2	5.6
25.01 to 50	23.8	30.4	29.6	18.4
50.01 to 75	24.8	23.2	29.6	32.8
75.01 to 100	16.8	12.8	12.0	12.0
100.01 to 150	8.8	12.8	15.2	17.6
150.01 and over	.8	12.8	2.4	13.6
Total	100.0	100.0	100.0	100.0

the negro families on poorer soil areas spent over \$75 for food, while only 38 per cent of the white families on better soil areas and 43 per cent of the negro families on better soil areas spent this much. The majority of negro families did not raise as much food on the home farm as white families, and, for this reason, quite a number had to purchase a large part of their food supply.

It is interesting to note that there were somewhat more families in low cash receipts than low cash expenditure groups.

White and Negro Families on Poorer and Better Soil Classified by Cash Receipts and Cash Expenditures—1934

Groups	White families				Negro families			
	Poorer soil		Better soil		Poorer soil		Better soil	
	Cash receipts	Cash expense	Cash receipts	Cash expense	Cash receipts	Cash expense	Cash receipts	Cash expense
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
\$ 100 and under	15.2	11.2	.8	.....	17.6	14.4	5.6	4.8
100.01 to 200	41.6	32.0	8.0	8.8	35.2	28.8	21.6	24.8
200.01 to 300	15.2	24.0	20.0	18.4	17.6	24.0	27.2	21.6
300.01 to 400	4.8	10.4	16.0	18.4	8.8	12.8	13.6	13.6
400.01 to 500	8.8	6.4	8.8	12.8	8.0	8.8	8.0	12.8
500.01 to 750	3.2	5.6	14.4	12.0	8.8	8.0	13.6	14.4
750.01 to 1000	4.0	3.2	7.2	5.6	1.6	1.6	8.0	4.8
1000.01 and over	7.2	7.2	24.8	24.0	2.4	1.6	2.4	3.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 21 gives the average amount of food produced on the farm by the families on the two soil areas. Most of the families on these areas had a garden; some of these families had vegetables almost the year around. String beans, cabbage, turnips, mustard, onions and tomatoes were the most common vegetables grown. There was little difference in this respect in the families on the two soil areas or in white and negro families. Peas, not usually considered a garden vegetable, but a field crop, were used quite extensively by all four groups. They were dried more frequently than any other vegetable; in fact, dried peas constituted one of the main foods in the diets of many. Collards were grown rather extensively by the negroes, but not so by the whites.

Although the white families on poorer soil averaged more milk cows per family than those on better soil, they were more often without a milk supply. This, of course, was due to the inferior cows of those on poorer soil. Negroes on better soil had the most inadequate milk supply of all, averaging milk only six months during the year. Some of these families did not have milk cows. Farmers often hesitate to turn over even a small portion of good land for grazing. The more productive the soil, the less likely it is to be used for grazing.

Table 21—Food Supply of White and Negro Families on Poorer and Better Soil*

Food supply	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Av. per family	Av. per family	Av. per family	Av. per family
Months with garden				
(1 or more vegetables)	9	10	7	7
Number milk cows	3	2	2	1
Number months with milk	10	11	8	6
Number pounds hogs killed	561	764	269	322
Number pounds other meat	4	5	5	6
Number fruit trees bearing	17	22	8	3
Fruit yield (bushels)	22	22	14	4
Number hens	27	27	14	13
Number bushels peanuts	5	6	5	3
Number bushels sweet potatoes	56	71	21	22
Number bushels nuts	21	44	15	07
Number quarts canned foods	115	154	39	35
Bushels dried vegetables	4	4	2	1
Bushels dried fruits	46	19	11	06
Gallons syrup	35	76	40	31

*A little more than 50 per cent of the families made their own cornmeal

Negroes on poorer soil much more frequently had fruit trees than those on better soil. This is largely due to the fact that there were few negro land owners on the better soil, and tenants hesitate to plant trees on land which they are likely to leave the following year. Peaches were the fruit most frequently produced by all four groups. Some families dried them for winter use. However, most of the peaches preserved for winter use were canned. Quite a bit of fruit was canned by white and negro families on both soil areas (Table 22). Fruit canned included wild fruits as well as peaches and other cultivated fruits. White families canned almost as many vegetables as fruits; the canning by negroes was almost altogether limited to fruits. Preservation of food other than fruits has undoubtedly not yet become common among negro families, at least in the areas studied. Many do not produce vegetables in sufficient quantity to can. Negroes on poorer soil raised and canned more vegetables than those on better areas.

In checking the available food supply of a group, and especially the meat supply, the fact that game is secured in large quantities by certain families is oftentimes overlooked. Three hundred of the families in this study supplemented

the meat supply produced or purchased in this way. More families on the poorer areas and more negroes than whites had caught fish and killed game during the

Table 22—Amount of Foods Canned by Whites and Negroes on Poorer and Better Soil

Item	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Per family	Per family	Per family	Per family
Quarts canned vegetables	44	52	7	5
Quarts canned fruits	46	64	25	23
Quarts canned meat	5	11	1	1
Quarts pickles, preserves and jelly	20	27	6	6
Total	115	154	39	35

year of the study. Rabbits were commonly killed by the negroes, squirrels by the whites (Table 23). This free supply of protein food may in some cases have made the difference between a pellagra and non-pellagra diet—an adequate and an inadequate diet.

Table 23—Kind of Game Secured by White and Negro Families on Poorer and Better Soil

Kind of game secured	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil'
	Number	Number	Number	Number
Rabbits	46	27	78	68
Birds	16	26	23	10
Squirrels	46	40	46	12
O'possums	3	3	7	9
Fish	32	35	57	25

In this study it seemed desirable not only to find out the kinds and amounts of foods raised on the home farm or secured without money cost, but also to work out some way of scoring this food supply. What supply should have been produced by these families and how far short of this standard did the families fall? Thus a food supply score card was worked out.¹² It will be noted (Table 24) that white families on poorer soil scored an average of 67 points out of a maximum 100 points and those on better soil 72 points, while negro families on poorer soil averaged 45 points and those on better soil 40 points. The fruit supply scores of all families on poorer and better soil, both white and negro were very low, in fact, lower than that of any other class of foods listed. The vegetable and poultry supply scores were also low. The milk supply score of negro families was more than 50 per cent under the standard set. White families on both soil areas more frequently made a food supply score of from 50 to 75 points. Negro families on better soil made lower food supply scores than did any of the other groups. Thirty-one of these 125 families were without a milk cow; 36 were without a fruit supply. Negroes on poorer soil had a somewhat better record. Only 25 of the 125 families on this soil had no milk cow; 34 had no fruit supply. White families on both soil areas usually produced at least a small amount of each class of food at home. There were only 11 of the 250 white families without a milk cow and 5 without a fruit supply.

Since a few of the families in this study purchased a large part of their food supply, while others depended principally upon food produced at home, the foods actually served in the home concerned doubtless varied considerably. Were inadequacies in home production made up by purchase? In order to answer this question the menus served in the 500 families the day of and the day before the interview

¹²See Appendix, page 37.

Table 24—Scores of Food Produced on Home Farm or Secured Without Money Cost* of White and Negro Families on Poorer and Better Soil

Food supply score	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Av. per family	Av. per family	Av. per family	Av. per family
Milk supply score	25.1	26.6	14.8	13.8
Meat supply score	7.1	8.0	4.5	4.8
Vegetable supply score	12.7	15.0	9.6	9.1
Fruit supply score	6.0	4.9	3.0	1.7
Poultry supply score	6.0	5.5	3.2	3.0
Syrup supply score	3.3	4.1	4.0	3.1
Peas, nuts, peanuts supply score	2.8	3.5	2.8	2.1
Potato supply score	4.1	4.5	3.3	2.6
Total	67.1	72.1	45.2	40.2

*Maximum scores: milk 30; meat 10; vegetable 20; fruit 15; poultry 10; syrup 5; peas, nuts, peanuts 5; potato 5; Total 100.

were obtained when taking the schedule. Families were revisited in July and in November for similar information.¹³

The menus served in the homes of the white families on better soil were, on

Table 25—Average Scores of a Two-Day Menu Served in February, July, and November (1935) by White and Negro Families on Poorer and Better Soil*

Foods served and time	White families				Negro families			
	Poorer soil		Better soil		Poorer soil		Better soil	
	Average score	Per cent of max.	Average score	Per cent of max.	Average score	Per cent of max.	Average score	Per cent of max.
Milk	16.3	53	20.9	69	14.0	47	14.9	50
February	13.8	46	20.2	67	9.3	31	9.6	33
July	17.4	55	18.0	60	17.3	59	19.3	64
November	17.6	58	24.5	81	15.0	50	15.9	53
Meat and Eggs	6.2	31	9.6	48	4.8	23	6.6	33
February	10.8	54	13.6	68	8.4	42	10.2	51
July	5.1	26	8.0	40	3.0	15	4.7	24
November	2.8	14	7.2	36	2.5	13	2.7	13
Fruits and Vegetables	23.7	53	25.7	57	10.1	22	10.3	23
February	17.2	38	17.8	40	3.8	8	5.6	12
July	32.7	73	33.5	74	14.4	32	11.1	25
November	21.2	47	25.7	57	12.2	27	14.2	32
Syrup	4.7	95	4.5	91	3.8	77	3.7	73
February	4.7	97	4.8	98	4.1	82	3.8	76
July	4.5	90	3.9	78	3.0	60	3.0	60
November	4.9	98	4.8	96	4.4	88	4.2	84
Total	50.9	51	60.7	60	32.7	33	35.5	35
February**	46.5	47	56.4	56	25.6	26	29.2	29
July***	59.7	60	63.4	63	38.2	38	38.1	38
November	46.5	47	62.2	62	34.1	34	37.0	37

*Maximum scores: milk 30; meat 10; eggs 10; syrup 5; fruits and vegetables 45.

**A few of these records obtained the last week in January and a few the first week of March.

***Menus from only 150 of the white and 150 of the negro families were obtained in July and November. However, the 300 families were typical of the 500 families as far as food production, cash expenditures for food, and type of menu served in February were concerned.

the whole, somewhat better than those served in the homes of white families on poorer soil, and this would be expected, as the food produced on the home farm,

¹³See Appendix, pages 37-38.

as well as cash expenditures for food of those on better soil, was greater. However, even though the negroes on poorer soil raised more food at home than those on better soil, their menus were slightly inferior to those on better soil. The negroes on better soil spent more cash for food and thus made up for the smaller amount of food produced at home.¹⁴

TYPICAL 2-DAY MENU OF WHITE FAMILIES IN JULY:

Total score 60. Nothing between meals

Between meals—peaches (5)

eggs. White families served more milk in November, but negro families in July. Milk is plentiful in July, but it is often not used generously then, due to warm weather and lack of facilities for keeping it cool, and to the fact that during this season cows often consume dog fennel and ragweed, thus giving an unpleasant flavor to the milk.

About 50 per cent of the negro families served no milk and about 50 per cent of them, no fruits or vegetables during the 2-day period in February. About two-thirds served no meat or eggs during the 2-day period in November (Table 26). November was likewise a poor month for meat and eggs for white families. Hogs are generally not killed until after the first heavy freeze in November, and the menus were collected before that date. There were more negro families than white families who did not serve the important food classes during the 6-day period studies. Indeed, negro families are sadly in need of a diversified farm program, in which a larger part of their food supply is produced at home.

Table 26—Number of White and Negro Families on Poorer and Better Soil Not Having Specified Foods in February, July and November, When a 2-Day Menu was Taken

Families not having:	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Number	Number	Number	Number
Milk				
February	21	8	65	66
July	3	4	11	4
November	4	1	9	13
Meat or eggs				
February	9	2	21	15
July	20	7	23	24
November	51	20	52	54
Milk, meat or eggs				
February	2	1	12	9
July	1	0	8	3
November	2	0	4	10
Vegetables or fruits				
February	4	6	54	43
July	0	0	6	6
November	0	0	4	9
None of these				
February	1	0	5	5
July	0	0	2	0
November	0	0	0	0

Stimulants, such as tobacco and alcoholic beverages, are sometimes included in the food group. The sale of strong alcoholic beverages is illegal in Mississippi, and, for this reason, the majority purchasing such beverages would hesitate to give this information. Seventeen of the 500 families reported an expenditure for an alcoholic beverage with an average expense of \$3.00 per family.¹⁶ Some families doubtless made their own drinks and reported the sugar thus used as an expenditure for food. Tobacco was used quite extensively (Table 27). A few families spent as much for tobacco as for food. For instance, one negro family on the poorer soil area with four children, aged 7 years, 4 years, 3 years, and 3 months, reported spending \$7.50 in cash during 1934 for food and \$5.00 for snuff. The menus for the 6-day period of this family scored only 25 points. That they scored even as much as 25 was due, of course, to the fact that cornmeal, meat and vegetables were raised on the farm. Another negro family consisting of a young man and wife reported spending \$20 for snuff, \$5 for chewing tobacco, and \$24.50 for food. Cigars and cigarettes, the more expensive forms of tobacco, were not used to the extent that chewing and smoking tobacco and snuff were used.

Table 27—Expenditures by White and Negro Families on Poorer and Better Soil for Tobacco

Item	White families				Negro families			
	Poorer soil		Better soil		Poorer soil		Better soil	
	No. with expense	Average amount	No. with expense	Average amount	No. with expense	Average amount	No. with expense	Average amount
Tobacco*	44	\$6.83	67	\$7.48	55	\$5.10	90	\$5.87
Snuff	46	5.52	37	5.75	68	5.35	71	5.47
Cigars and cigarettes	22	7.82	12	15.22	11	5.81	5	2.62

*Chewing and smoking.

The majority of families, white as well as negro, served breakfast from 6:00 a. m. to 6:30 a. m. Few served it after 7:00 a. m. More negroes served late breakfast (7:30 a. m. or later) than did whites. The fact that many negro families had only two meals probably accounts for their late breakfasts. Dinner was served at noon by the majority of families. Quite a number of negro families served dinner from 3:00 p. m. to 5:00 p. m. These were in the group having only two meals a day. Supper was generally served from 6:30 to 7:30 p. m. The families having only two meals a day did not serve supper.

Table 28—Number of Meals Served per Day in February by White and Negro Families on Poorer and Better Soil

Number of meals	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Number	Number	Number	Number
1	0	0	0	1
2	6	1	68	42
3	119	124	57	82
Total	125	125	125	125

The majority of families in this study ate all three meals in the kitchen, though breakfast was somewhat more likely to be eaten there than the other two meals (Table 29). The reason for eating in the kitchen rather than in the dining room was, in most cases, the absence of a dining room. For this reason white families

Table 29—Place Which White and Negro Families on Poorer and Better Soil Ordinarily Ate Their Meals

Place of eating meals	White families		Negro families	
	Poorer soil	Better soil*	Poorer soil	Better soil
	Number	Number	Number	Number
Breakfast				
Kitchen	72	60	87	105
Bedroom	...	...	15	3
Diningroom	53	64	23	17
Dinner				
Kitchen	59	51	85	102
Bedroom	...	...	14	2
Diningroom	66	73	26	21
Supper				
Kitchen	53	54	39	68
Bedroom	...	...	7	...
Diningroom	61	69	11	14

*One family ate all three meals in their living room.

more often ate their meals in the dining room than negro families, white families on better soil than those on poorer soil, and negro families on poorer soil than those on better soil.

¹⁶The sale of beer and light wines was legalized in Mississippi in February, 1934.

Oil cloth was the table covering used by the great majority of families in the study. Thirty-nine negro families and two white families used no table covering; cotton or linen was used by a few. The number of families with household help was small, and this explains in part the general use of oil cloth as a table covering. White families on better soil and negro families on poorer soil more often used cotton or linen than did the other two groups. They more frequently had dining rooms, and dining rooms are more conducive to the use of linen or cotton cloths.

Table 30—Kind of Table Covering Used by White and Negro Families on Poorer and Better Soil

Kind of table cloth	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Number	Number	Number	Number
None	2	0	26	13
Oil cloth	112	104	90	109
Cotton or linen	10	21	4	0
Feed or flour sacks*	0	0	2	0
Information not secured	1	0	3	3
Total	125	125	125	125

*Several of the cloths listed as cotton may have been feed or flour sacks.

CLOTHING AND PERSONAL EXPENSES

In this study the cash expenditures for clothing were not greatly exceeded by the cash expenditures for food, the average amount for clothing being 27 per cent of the total cash expenditures for the family, and that of food, 34 per cent. In only 20 per cent of the families did the clothing expenditures amount to more than 35 per cent of the total family expenses, while in 50 per cent of the families, the food expenditures amounted to this much. However, there were more families with high clothing expenditures than there were with high food expenditures.

About 83 per cent of the amount spent for clothing was spent to purchase ready-made garments. White and negro families on poorer and on better soil did not differ in this respect. The majority of negro families on both soil areas and of white families on poorer soil spent from \$25.00 to \$50.00 for clothing, while the majority of white families on better soil spent from \$50.00 to \$100.00 for clothing. Only 9 per cent of the white families on poorer soil spent more than \$100 for clothing, while 29 per cent of the white families on better soil spent this much (Table 31). White families on better soil were slightly larger; then, too, the individual members in these families spent more for clothing (Table 32). For instance, the daughters 14 to 18 years of age of white families on poorer soil spent \$15.75 for clothing, while those on better soil spent \$22.55. Daughters of negro families 14 to 18 years of age on poorer soil spent \$9.66 for clothing, while those on better soil spent \$11.78 for clothing.

Table 31—Variation in Clothing Expenditures of White and Negro Families on Poorer and Better Soil

Amount spent for clothing	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Per cent	Per cent	Per cent	Per cent
\$ 25 and under	23.2	12.8	34.4	20.8
25.01 to \$ 50	42.4	21.6	36.0	39.2
50.01 to 100	25.6	36.8	21.6	29.6
100.01 to 150	4.8	16.8	6.4	6.4
150.01 to 250	4.0	8.0	1.6	4.0
250.01 and over	0	4.0	0	0
Total	100.0	100.0	100.0	100.0

Expenditures for clothing of the members of all four groups showed certain

general tendencies; namely, for the father's expenditure to be greater than the mother's and that of sons and daughters 19 years and over to be greater than that of fathers and mothers, and for children under 6 years to have the lowest clothing expenditure of all. This is a tendency usually observed in the clothing expenditures of low income families. In high income groups the wife's expenditures for clothing are generally greater than the expenditures of the husband.

Table 32—Average Clothing Expenditures per Person of White and Negro Families on Poorer and Better Soil

Persons for whom clothing secured	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Per person	Per person	Per person	Per person
Fathers	\$14.81	\$22.22	\$13.23	\$14.54
Mothers	11.37	16.63	9.02	10.74
Other men*	31.30	28.31	14.84	12.69
Other women*	11.45	9.38	6.05	13.96
Sons 19 years and over	25.07	37.79	18.56	19.25
Sons 14-18 years	16.73	19.75	12.48	13.54
Sons 6-13 years	9.44	10.49	6.19	7.33
Sons under 6 years	6.99	6.04	3.64	4.01
Daughters 19 years and over	18.16	21.81	17.58	10.70
Daughters 14-18 years	15.75	22.55	9.66	11.78
Daughters 6-13 years	8.73	10.60	5.12	5.58
Daughters under 6 years	4.21	6.85	3.03	3.68

*Those 19 years and over securing clothing from family cash income (not sons or daughters).

Expenditures for clothing are usually classified into five groups: headwear, outer garments, under garments, footwear, and accessories. In this study, about one-half of the clothing money was spent for outer garments, one-third for footwear and one-tenth for under garments (Table 33). Expenditures for headwear and accessories were negligible.¹⁷ The proportion of the clothing dollar going for the five classes of clothing in white and negro families on the poorer or better soil did not differ greatly, though the proportion spent for outer garments by families on better soil was somewhat greater and the proportion for footwear somewhat

Table 33—Percentage Distribution of Clothing Expenditures by Clothing Groups of White and Negro Families on the Two Areas

Clothing groups	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Per cent	Per cent	Per cent	Per cent
Headwear	5.5	4.9	5.8	6.3
Outer garments	48.8	52.8	47.1	48.6
Under garments	11.1	10.6	12.1	12.6
Footwear	33.4	28.5	33.5	30.8
Accessories	1.2	3.2	1.5	1.7
Total	100.0	100.0	100.0	100.0

less than by families on poorer soil. Very few clothing accessories, such as belts, ties, garters, and gloves were purchased. However, the few purchased were generally purchased by families on more productive soil.¹⁸ Families on such soil not only purchased more clothing accessories, but paid more per article for accessories purchased.

In Table 34 are listed the cash expenditures for certain specific clothing items

¹⁷It is interesting to note that about this same proportion was spent for various clothing groups in a study made of clothing expenditures of Mississippi farm families in 1928-29. Mississippi Agricultural Experiment Station, Bulletin No. 294.

which families could do without, or for which they could substitute cheaper items. As may be noted, families on better soil more often had expenditures for such items than those on poorer soil. For instance, 22 white families on poorer soil bought women's coats, while 45 white families on the better soil had this expense.

Table 34—Expenditures for a Selected List of Articles of Clothing by White and Negro Families on Poorer and Better Soil

Item	White families						Negro families					
	Poorer soil			Better soil			Poorer soil			Better soil		
	No. fam. with exp.	Av. with exp.	Av. in study	No. fam. with exp.	Av. with exp.	Av. in study	No. fam. with exp.	Av. with exp.	Av. in study	No. fam. with exp.	Av. with exp.	Av. in study
Hats	99	\$3.41	\$2.70	112	\$4.82	\$3.87	108	\$2.85	\$2.46	114	\$3.12	\$2.85
Coats (women)	22	6.72	1.18	45	9.75	3.51	24	4.85	.93	27	7.45	1.61
Overcoats (men)	3	5.58	.13	6	11.96	.57	5	8.90	.36	3	10.00	.24
Suits (men)	15	17.50	2.10	42	22.31	7.49	6	11.66	.56	11	17.68	1.56
Silk dresses*	22	4.62	.81	41	6.28	2.06	23	4.96	.91	26	4.59	.95
Kimonas and robes	4	3.31	.11	2	4.88	.08	1	1.79	.01	.....	.....	.....
Silk hose*	77	2.13	1.32	106	2.60	2.21	70	1.79	1.00	85	1.66	1.13
Cleaning and pressing	2	.55	.01	18	4.09	.59	5	1.05	.04	4	1.64	.05

*In some cases the dresses and hose reported as silk were doubtless rayon. At least, these consumers thought they were buying silk articles.

Seventy negro families on poorer soil purchased silk hose, while 85 negro families on better soil made this purchase. It is possible, of course, to do without a hat, or to use the same hat for many years. Sweaters can be used instead of coats,

Table 35—Number of Some of the Most Common Articles of Clothing Added to the Clothing Supply During 1934 and Per Cent Made at Home by White and Negro Families on Poorer and Better Soil*

Articles of clothing	White families				Negro families			
	Poorer soil		Better soil		Poorer soil		Better soil	
	Total num- ber	Home- made per cent	Total num- ber	Home- made per cent	Total num- ber	Home- made** per cent	Total num- ber	Home- made per cent
Coats	48	31	86	12	37	5	47	2
Cotton dresses	827	81	1198	88	878	87	999	85
Wool dresses	17	29	28	32	1	.....	11	45
Silk dresses	40	48	77	45	54	46	50	48
Blouses	23	43	16	56	7	.....	8	.....
Skirts	13	62	17	59	15	60	9	.....
Slips and petticoats	301	81	472	81	443	88	429	84
Aprons and smocks	142	94	92	92	148	90	127	95
Bloomers	281	38	532	35	355	44	409	23
Chemises and teddies	50	54	35	94	19	58	3	.....
Men's winter underwear	218	1	289	2	249	11	288	1
Men's summer underwear	161	9	245	8	120	9	161	.....
Brassieres	85	14	134	19	24	29	24	.....
Gowns and pajamas (women)	115	75	259	85	64	78	102	55
Night shirts and pajamas (men)	13	15	72	69	9	.....	9	.....
Shirts and blouses (men and boys)	574	14	977	38	575	21	599	15

*This does not include gifts; only clothing in which a cash expenditure is made.

**Percentage of garments homemade not figured where less than ten garments.

cotton dresses and hose instead of silk. One can discard one's garments after a year or two, or can extend their use by remodeling, darning, and patching. Cleaning

18See Table 5, Appendix B, page 41.

and pressing can be done at home. Such are the adjustments which families make who have little money available for clothing.

White families on better soil and negroes on poorer soil did more home sewing. As has been shown, the negroes on the poorer soil more often owned their homes and had more formal education than those on better soil, or were, in other words, somewhat superior. This was likewise true of white families on better soil as compared with those on poorer soil. Whether it pays to sew would depend, of course, on opportunities for profitable use of time for some other purpose and cash available for purchasing clothing. The cash available for purchasing clothing was quite limited for most of the families in the study. Many had time which could have been used profitably in making garments. Lack of the proper equipment doubtless led some to decide in favor of the ready-made garments. Only 88 of the white families on the poorer soil owned sewing machines, while 111 of those on more fertile soil owned machines. Fifty-eight of the negro families on each area owned a sewing machine. It is interesting to note that although fewer negro families on poorer soil had machines than did white families on the same soil, negro families made more garments at home. An inventory of the clothing which each member of these families had would perhaps give a better picture of the clothing situation in these four groups than do their cash expenditures for clothing.

The garments more frequently made at home by all four groups were cotton dresses, slips and petticoats, aprons and smocks, and gowns and pajamas. In fact, 75 per cent or more of these garments were homemade. Men's winter and summer underwear were the articles which were less often made at home. White families on better soil made a much larger proportion of the shirts, blouses and underwear in the home than did white families on poorer soil. Coats were the only garment made much more often by white families on poorer soil than white families on better soil. All kinds of garments were made about as frequently or more frequently by negro families on poorer soil than by those on better soil.

Table 36—Personal Expenses of White and Negro Families on Poorer and Better Soil

Item	White families				Negro families			
	Poorer soil		Better soil		Poorer soil		Better soil	
	No. fam.	Average with exp. amt.	No. fam.	Average with exp. amt.	No. fam.	Average with exp. amt.	No. fam.	Average with exp. amt.
Toilet articles	117	\$1.70	119	\$2.64	108	\$1.12	117	\$1.32
Barber and beauty parlor	17	3.70	40	5.30	12	1.88	18	1.79
Allowance and spending money	5	5.30	7	14.64	3	4.50	6	4.08
All other	2	.90	6	2.36	9	.52	6	.62

Closely related to clothing expenditures whose principal function is that of adornment are expenditures for a similar purpose—toilet articles, barber and beauty parlor. When clothing expenditures are low, one would expect such expenditures as toilet articles, barber and beauty parlor to be low also, and this is the case (Table 36). Families on the poorer soil areas less frequently had these expenses, and spent less per family when they did than did those living on better soils. The fact that so few had expenditures for barber and beauty parlor does not mean, of course, that the members of these families went with their hair untrimmed, but that certain families owned clippers and cut the hair of their neighbors and friends gratis or in exchange for other small favors

THE HOUSE, FURNITURE, FURNISHINGS, AND HOUSEHOLD OPERATION

The houses in which the negro families on both soil areas more frequently resided consisted of three rooms—two bedrooms and a kitchen—while the houses in which white families on the poorer soils more often resided were 4-room structures consisting of two bedrooms, a diningroom and a kitchen. The majority of the white families on better soil had 5-room structures (Table 37). Thirteen negro

families lived in one-room structures. Eleven of these were from the poorer soil areas. Only four white families lived in houses of less than three rooms, while 67 negro families did so. The houses of the families both negro and white on better soil were somewhat larger than those on poorer soil.

Table 37—Number Rooms in the Houses of White and Negro Families on Poorer and Better Soil

Number of rooms in house	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Number	Number	Number	Number
1	---	---	11	2
2	4	---	24	30
3	18	13	41	46
4	42	29	33	29
5	38	40	9	13
6	20	27	7	3
7	3	14	---	2
8	---	2	---	---
Total	125	125	125	125

Unpainted frame houses predominated for whites and negroes on both soil areas. Many of the houses were in need of repair. Frequently, the house needed replacement. Since the majority of families in this study made low incomes, neglect of the physical structure was quite common. Expenditures for housing repairs are generally not considered as necessary as expenditures for many other types of goods. Only nine white families on the poorer soil and sixteen on the better soil had an expenditure for housing repairs and replacements. Only four negro families had these expenditures. Three of these lived on poorer soil where ownership of homes was more common. Ten families in the study carried fire insurance on their houses; seven of these were white families on the better soil, two white families on poorer soil. Only one negro family carried fire insurance.

Some families were living in houses too small for their needs, others in houses too large. The great majority of families in all four groups had two bedrooms (Table 38). In about 30 per cent of the families with two bedrooms there were more than five members in the household; in about 38 per cent three members or less. Houses of negro families were more likely to be overcrowded than were houses of white families. About 150 of the negro families had less than a bedroom to two persons, while about 65 of the white families had this amount. It was al-

19Relation of number of bedrooms to number of members of household

Number of members	1 bed room		2 bed rooms		3 bed rooms		4 bed rooms		5 bed rooms		6 bed rooms	
	Negro		White		Negro		White		Negro		White	
	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
2	19	---	22	20	2	17	---	3	---	---	---	---
2.1 to 3.....	17	3	21	31	3	17	---	4	---	---	---	---
3.1 to 4.....	16	3	21	25	5	14	2	6	---	---	---	---
4.1 to 5.....	9	---	20	12	1	18	---	8	---	---	---	---
5.1 to 6.....	7	---	15	12	3	14	---	1	---	---	---	---
6.1 to 7.....	3	---	13	4	8	8	1	1	---	---	---	---
7.1 to 8.....	1	---	3	5	3	3	---	---	---	1	---	---
8.1 to 9.....	1	---	6	2	2	3	1	3	---	1	---	---
9.1 to 10.....	---	---	6	1	3	3	3	4	---	---	---	---
10.1 to 11.....	---	---	2	---	---	---	1	---	---	---	---	---
11.1 to 12.....	---	---	---	---	---	1	2	---	---	---	---	---
12.1 to 13.....	---	---	2	---	2	---	---	2	1	---	1	---
13.1 to 14.....	---	---	1	---	1	---	---	---	---	---	---	---
Total	73	6	132	112	33	98	10	32	1	2	1	---

most exactly the reverse in the case of the number of white and negro families having more than a bedroom for every two persons, there being about 150 white families and 65 negro families with this much bedroom space.¹⁹ Many of the houses of white families had been built years ago when the family was larger than at the present time. Some of the rooms were not used. More rooms were used in summer than in winter, due to the necessity of heating in winter.

Table 38—Number of Bedrooms of White and Negro Families on Poorer and Better Soil

Number of bedrooms	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Number	Number	Number	Number
1	6	....	39	34
2	55	57	64	68
3	49	49	17	16
4	14	18	5	5
5	1	1	....	1
6	---	---	---	1

Reduction in the number of rooms regularly heated was one of the methods generally used to cut household cost. Fuel was obtained by the majority of the families without money cost, but much time cost was involved. For this reason, few families had heat regularly in any room except the mother's bedroom. Indeed, the mother's bedroom was the living room of the family, the place where the children studied, the father read and the mother patched—the place where the company was received! Only 25 of the 500 families had heat in more than two rooms. Some of the families with dining rooms did not heat these regularly and so ordinarily ate in the kitchen. Although 244 families in the study had dining rooms (Table 39), only 186 ordinarily ate in these rooms. Of course, the convenience of serving in the room where the food is cooked as well as the desire to save fuel entered into the decision to eat in the kitchen instead of in the dining room.

Table 39—Number of White and Negro Families on Poorer and Better Soil Having a Dining Room, Kitchen and Parlor

Rooms	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Number	Number	Number	Number
Dining room	81	91	36	26
Kitchen	125	125	114*	123*
Parlor	15	45	1	4

*The other families cooked in a bedroom. Had only one room.

Next to a bedroom, the families in this study most frequently had a kitchen. All white families had a kitchen, and all negro families except 11 on the poorer soil and two on the better soil had one (Table 39). These 13 families without kitchens cooked and served in their bedroom. Dining rooms were found more frequently in the houses of white families on better soil and of negro families on poorer soil. Very few families had a parlor. Practically no negro families did. The mother's bedroom takes the place of a parlor in the winter time; the front porch takes the place of a parlor in the summer time.

Very few of the houses had closets (Table 40). Closets, of course, add to the cost of the house and for this reason are often not included. Clothing and other articles that must be stored were put away in wardrobes or trunks, hung on nails on the bedroom walls or put into boxes under the bed. White families on the better soil more frequently had closets and had more closets in their houses than did white families on poorer soil. Indeed, the number of white families on poorer

soil and of negroes on both soils having closets in their houses was almost negligible.

Table 40—Number of Closets in Homes of White and Negro Families on Poorer and Better Soil

Number of closets	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Number	Number	Number	Number
None	96	65	106	102
1 closet	11	24	13	14
2 closets	17	25	6	8
3 closets	1	8	....	1
4 closets .....	....	3	....	....
Total	125	125	125	125

Kerosene lamps supplied light in practically all the homes. Two white families on the more fertile soil and one on the poorer soil had Delco plants; nine negro families and four white families reported firelight only. During 1934 kerosene or lighting cost the white families on the better soil an average of \$3.35, the white families on the poorer soil \$1.69, the negro families on the better soil \$2.17, and the negro families on the poorer soil \$1.47.

Table 41—Method of Lighting Used by White and Negro Families on Poorer and Better Soil

Method of lighting	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Number	Number	Number	Number
Firelight	3	1	7	2
Kerosene	119	122	118	123
Carbide	2	....	....	....
Delco plant	1	2	....	....
Total	125	125	125	125

Just as kerosene lamps supplied the light, so did fireplaces supply the heat. Only 9 white families and 4 negro families used stoves for heating.²⁰ In other words, all except 13 families in this study relied altogether on fireplaces for heat. No house had a central heating system. Twenty-five white families on the better soil and eight on the poorer soil had cash expenditures for fuel, while only four negro families on the better soil and none on the poorer soil had cash expenditures for

Table 42—Kind of Toilet of White and Negro Families on Poorer and Better Soil

Kind of toilet	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Number	Number	Number	Number
None	72	26	83	60
Outside privy	52	96	41	65
Information not obtained	1	3	1	....
Total	125	125	125	125

this item. The majority of families, both white and negro, on both soil areas secured their fuel supply from wooded land on their own farms or land nearby without money cost.

Most families in this study obtained their water supply from wells located in their yards. A few had cisterns, this being more common among families on the poorer soil and more common among negroes than whites. Thirty-seven negro families on the poorer soil and 52 on the better soil secured their water supply

²⁰Does not refer to kitchen stove. Rural families of Mississippi do not sit in the kitchen.

from the well or cistern of a neighbor. Only 15 white families, 7 on the better soil and 8 on the poorer soil were so inconvenienced. Indeed, it is quite common to meet negro children on the road carrying buckets of water! Such a situation, of course, is likely to result in underconsumption of an item which should be generously used. Nine white families on the better soil, five on the poorer soil and two negro families on the poorer soil had their water supply on the porch. No family in the study had water in the house.

Table 43—White and Negro Families on Poorer and Better Soil Having Houses Screened

Screens	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Number	Number	Number	Number
No screens	74	59	117	113
Screens	51	65	7	12
Good	24	39	2	4
Fair	15	20	1	4
Poor	12	6	4	4
Information not obtained	...	1	1	...
Total	125	125	125	125

The majority of families on poorer soil, both white and negro, had no toilet facilities, while the majority of families on better soil had a privy (Table 42). No family had a flush toilet. Few homes of negroes were screened (Table 43). Over one-half of the homes of white families on better soil were screened, and in the majority of these homes the screens were in good condition. Forty-one per cent of the white families on poorer soil had their homes screened. From this it would seem that many families on these soil areas had made little provision for sanitation. This was more true of the families on poorer soil where cash earnings were less.

A sewing machine was the piece of labor-saving equipment most frequently found in the homes of all four groups (Table 44). Only 15 families had pressure cookers, only 13 families ice boxes or refrigerators. However, 47 white families on better soil, 23 on poorer soil, 25 negro families on better soil and 11 on poorer soil purchased some ice during the year. The majority who purchased ice bought it irregularly and then for immediate use. Getting ice meant a trip to town, as ice is not ordinarily delivered in rural areas. Then, of course, so low were the incomes of these rural families that few could afford this "luxury." Cool foods, however, go a long way in making a summer diet palatable. Perhaps ice plays as important a role in providing family comfort in Mississippi as a central heating system does in Maine.

Table 44—Labor-Saving Equipment Owned by White and Negro Families on Poorer and Better Soil

Equipment	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Number	Number	Number	Number
Sewing machine	88	111	58	58
Pressure cooker	2	12	1	...
Ice box or refrigerator	1	10	2	...
Oil stove	...	1	...	...

No family in the study had a mechanical washing machine, although only 26 white families on better soil and 14 on poorer soil hired laundering done. Indeed, home as well as farm work was performed in most instances by members of the family with little or no labor-saving equipment. Commercial power lines did not run through any of the communities studied. Only 22 families had telephones, 15 of these on the poorer soil areas. All of these families lived in one community, and the telephone service was a local service costing only \$4.00 a year.

Washing was usually done in the yard near the well, both winter and summer. Negro families more often did their washing in the house during winter than white families. When laundering was done in the house, it was done in the kitchen. The majority of families on both soil areas made their own soap. During the year of the study, an average of ten gallons was made by white families on poorer soil and seven gallons by negroes on this soil. Nearly one-half of the white and negro families on better soil made their soap. One hundred and eight white families and 109 negro families on poorer soil made their brooms from sedges, while 65 white families and 69 negro families on better soil made them from sedges. Such practices as making soap and brooms at home explain in part the low household operating costs of many of the families in this study. No family reported making candles.

The majority of families in all four groups had some expenditure for furniture or furnishings during the year (Table 45), although more families on the better soil had these expenditures than did those on poorer soil areas. Only 38 white families on the better soil, 14 on the poorer soil, 14 negro families on the better soil and 8 on the poorer soil spent over \$10.00 for furniture and furnishings. Household furnishings were more frequently purchased than furniture, and bed linen more often than any other type of household furnishings. Expenditures for furniture and furnishings were not, for the majority of families, an important item. In only 15 of the 250 white families, and 7 of the 250 negro families did such expenditures amount to more than 10 per cent of the total amount spent for family living.

Table 45—Expenditures for Furniture and Furnishings by White and Negro Families on Poorer and Better Soil

Item	White families				Negro families			
	Poorer soil		Better soil		Poorer soil		Better soil	
	No. fam. with exp.	Average amt.	No. fam. with exp.	Average amt.	No. fam. with exp.	Average amt.	No. fam. with exp.	Average amt.
Furniture	9	\$23.44	18	\$34.05	10	\$6.36	10	\$9.23
Sewing machines			1	\$2.00				
Stoves							5	\$8.85
Pictures			2	2.50				
Rugs	3	12.16	16	5.17	1	6.00	1	3.50
Curtains	10	2.04	23	2.08	15	1.11	7	.90
Bed linen	81	2.96	108	3.50	76	2.18	84	2.08
Towels	53	.78	57	.89	22	.52	30	.72
Fire insurance			1	29.00				
Other*	107	1.38	112	3.14	99	.92	109	1.74
Total	116	6.01	122	13.25	108	3.37	114	5.93

*Luggage, lamps, kitchen utensils, table ware, repairs

Dr. Chapin of the University of Minnesota has worked out a method of scoring family status based on material objects found in the living room of the family. It was decided to score the living rooms of the white and negro families on the two soil areas with this scale. Chapin's scale has been standardized on families living under urban conditions, but it was thought that it could be used without great difficulty on farm homes. One of the chief points of difference was the fact that the majority of these farm homes did not have any real living room. Nevertheless there was a large proportion of items on Chapin's scale which would apply to all homes no matter how low the status. At the suggestion of Chapin, four changes were made in his scale for use in this study.²¹ These changes were made after re-examining the results of an unpublished study conducted in 1931 in 192 homes

²¹Item 6 was made to apply to any table in the room and not merely to a library table. Items relating to a piano bench, sewing machine and alarm clock were omitted. See Appendix, page 38, for scale used.

of mountain families of North Carolina, which group presumably corresponded more nearly with the families in this study than with urban families for whom the scale was originally intended.

Table 46—Social Status of White and Negro Families on Poorer and Better Soil Scored According to Chapin's Scale

Social status	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Per cent	Per cent	Per cent	Per cent
Destitute (0-24)	32.8	27.2	68.0	73.6
Relief (25-49)	39.2	24.8	24.0	20.0
Working man's home (50-74)	17.6	21.6	7.2	6.4
Lower middle class (75-99)	6.4	14.4	.8	.....
Average middle class (100-124)	2.4	8.0	.....	.....
Upper middle class (125-144)	1.6	4.0	.....	.....
Total	100.0	100.0	100.0	100.0

As may be noted in Table 46, the majority of families in all four groups fell in the "destitute" and "relief cases" groups. In fact, more than 90 per cent of the negroes were in these two groups. Negro families on poorer soil scored somewhat higher than did those on better soil. This, of course, would be expected in view of the other findings regarding this group. Fifty-two per cent of the white families on better soil and 72 per cent on poorer soil fell in the "destitute" and "relief cases" categories. In a study made by Chapin of 354 relief and non-relief families in the city of St. Paul²² only 38 per cent of the relief families and 11 per cent of the non-relief families scored "destitute" or "relief cases".²³

SICKNESS AND DEATH

In 17 white families on poorer soil, 9 white families on better soil, 11 negro

Table 47—Expenditures for Sickness and Death by White and Negro Families on Poorer and Better Soil

Item	White families				Negro families			
	Poorer soil		Better soil		Poorer soil		Better soil	
	No. fam. with exp.	Average amt.	No. fam. with exp.	Average amt.	No. fam. with exp.	Average amt.	No. fam. with exp.	Average amt.
Physician's prescription	38	\$6.25	46	\$6.34	34	\$3.68	36	\$3.46
Patent medicine	45	3.45	50	3.44	76	2.08	68	2.29
Eye glasses and other appliances	11	2.57	17	6.83	8	3.61	2	4.75
Physicians and surgeons	64	20.85	87	22.97	47	16.55	42	11.82
Chiropractor	4	14.50	2	63.50	.....	.....	.....	.....
Hospital	5	93.20	5	27.59	2	118.25	1	47.00
Midwife .....	.....	.....	.....	.....	1	8.00	3	6.67
Nurse .....	.....	.....	.....	.....	1	10.00	.....	.....
Dentist	29	8.89	49	10.27	18	3.50	14	3.10
Funeral	3	23.91	1	25.00	7	25.50	3	22.50
Total	100	26.09	124	27.18	101	15.70	99	9.74

families on poorer soil and 1 negro family on better soil, expenditures for sickness and death were more than 25 per cent of the total expenditures for family living.

²²Unpublished material loaned the writer by Dr. Chapin.

²³There were certain items in Chapin's scale which rural families of supposedly high social status in the South rarely have. For this reason a few of the items and weights were changed, and when the families were revisited for securing 2-day menus, the additional information needed concerning their living rooms was then obtained and scores on the basis of this new scale worked out. Very low scoring living rooms scored slightly lower with the revised than with the unrevised scale. As the living room improved the two scales gave about the same score. Still further improvement resulted in higher scores from the revised scale. A report of this study will be found in the December, 1937, issue of the Journal of Home Economics.

In other words, the groups with less to spend had a relatively greater expense to bear. Low income families usually do not seek medical attention until it becomes most urgent, while families better situated financially more often consult physicians and dentists for minor ailments or seek information which will keep them in good physical condition. This undoubtedly explains the greater cash expenditure for medical care by white families on better soil.

Expenditures for sickness and death varied quite considerably among individual families. Fifteen families, 11 whites and 4 negroes, spent more than \$100 during the year for these items. This is an expense which, of course, cannot be estimated ahead. It is unexpected, and for this reason is often resented. In this study many of the families having these expenditures still owed for them. In fact, bills for medical care were more frequently unpaid than for any other goods or services.

Some interesting differences are noticed in the expenditures of white and negro families for medical care. More negroes purchased patent medicine than did whites. This was no doubt due to the fact that quite a few prescribed for their own ailments in order to save on doctors' bills. Many looked upon the use of a patent medicine as the cheapest form of medicament they could secure. Relatively few negroes visited the dentist and those who did averaged about \$3.00 per family for such services. The dentist was without doubt never consulted except in cases of immediate necessity. Indeed, so low were the incomes of these negroes that few had money available to purchase anything except the actual necessities. Midwives are generally used by negro women at the birth of their children, while white women are generally attended by physicians.²⁴ This is, of course, due to the fact that the services of the midwife cost less. In brief, whatever differences are found in the expenditures for medical care of white and negro families are probably largely due to differences in the financial status of the two groups. Need for medical services for all groups is perhaps increased by inadequate food and shelter and an inadequate and impure water supply.

ACTIVITIES ENGAGED IN

Butchering, plowing, care of livestock, picking cotton, chopping wood, care of fires, curing meat, hoeing cotton, caring for the garden and carrying water were the farm and home activities engaged in by more of the husbands of the families in this study. White men more often carried water and cared for the garden than did colored men. More colored men plowed and picked cotton than did white men. No consistent difference in the activities of the husbands on the two areas was found. White husbands on the better soil, however, less often plowed and cut wood, two of the heaviest farm tasks, than did white husbands on poorer soil, or negro husbands. This, of course, was due to the fact that they more frequently had hired help who could do this heavy work.²⁵

Cooking, canning, mending, quilting, washing, sewing, cleaning house, gathering vegetables, care of chickens, care of garden, care of milk, making sausage, churning, washing dishes and care of flowers and lawn were the activities engaged in by more of the wives of the families in the study. More negro women butchered and cured meat, while more white women cared for the milk and the flowers and lawn. White families more often had milk cows, flowers, and sodded lawns, and it is, therefore, not surprising that the women in these families more often engaged in such activities. However, the greatest difference found in the activities of white and colored wives was in the number hoeing and picking cotton. This was an activity regularly engaged in by about 80 per cent of the colored wives and by only 40 per cent of the white wives. It is interesting to note that the wives of white men on better soil less frequently engaged in the varying home and farm duties

²⁴Midwives are used by a number of white families in the lower economic strata, however.

²⁵See Tables 4, 5, 6, 9, 10, and 11 in the Appendix for a summary of farm and home activities engaged in, by husbands, wives and children of families in this study.

than did those on poorer soil, or than wives of negro men. This was, of course, due to the fact that they more often had household help than did the wives of the other groups. Twenty-six of the wives of white farmers on better soil, 14 on poorer soil and 3 wives of negro farmers had an expenditure for household help during 1934, the year of the study.

The members of a farm family share in the activities of the farm and home. Thus about one-third of the husbands and four-fifths of the wives make sausage. In other words, there are few activities engaged in by members of farm families which are done by the husband or wife alone. Hoeing, picking cotton and carrying water are family activities. Certain activities are carried on more often by mother and daughters, other activities by father and sons. However, there are no distinctive masculine or feminine tasks on the farm. There are a few wives who plow and care for the livestock; a few husbands who cook, iron and churn.

Plowing, chopping wood, picking cotton, hoeing, care of fires, butchering, care of livestock, milking, carrying water, and curing meat were the activities engaged in by more of the sons 14 years and over in this study. About the same proportion of sons as fathers plowed, hoed, picked cotton and chopped wood. However, care of the livestock and fires and butchering were more frequently the father's task, milking and carrying water tasks of sons. Sons 14 years and over from families containing the greatest percentage of landowners more often engaged in farm and home tasks. Thus relatively more sons from white families on better soil and negro families on poorer soil hoed, plowed, cared for the livestock and garden, milked and chopped wood. Sons from non-owner families leave home earlier. This results in families of this tenure having relatively fewer older sons at home.

Just as the activities of the older sons closely followed the activities of their fathers, so the activities of the older daughters closely followed the activities of their mothers. Cleaning house, washing, ironing, canning, picking cotton, hoeing, cooking, care of flowers and lawn, gathering vegetables, quilting, carrying water, sewing, milking and churning were the activities engaged in by more of the daughters 14 years and over. Indeed, the tasks of farm women are much more numerous than are those of farm men. They help make the crop, as well as carry on all the regular household tasks. The farm wife in this study did the household tasks more often than did her older daughters, while the older daughters more often did field work than did their mothers. Daughters of negroes worked more on the farm and in the home than did daughters of whites. Especially was this true of work on the farm. The daughters of white families on better soil less often carried on the more unpleasant tasks of the household, such as carrying water, care of fires, milking and laundry work. This is the kind of work that some of their families employed servants to do. On the other hand, more of these young women sewed and canned than did those in the other three groups.

The activities engaged in by more of the sons 8 to 13 years of age were picking cotton, hoeing, carrying water, chopping wood, care of fires, plowing, milking, care of livestock and butchering. These activities with one exception were engaged in more often, however, by older sons. Carrying water was apparently the work more frequently delegated to the small boy of the family. Younger sons, both white and negro, on better soil more often did farm work, such as caring for livestock, hoeing, and picking cotton than did those on poorer soil. On poorer soil there was, of course, less farm work to do, and the farm work would, therefore, more likely be handled by the father and older brothers at home.

The activities followed by more of the daughters 8 to 13 years of age were picking cotton, washing dishes, hoeing, carrying water, ironing, cleaning house, care of flowers and lawn and washing. These daughters did every task that their older sisters did, but not quite as often, except for caring for small children. This activity seemed to belong especially to them. The negro girl of 8 to 13 years did farm work more often than did the white girl, while white girls more frequently did household work. There were no consistent differences in the activities of

daughters of white or negro families on the two soil areas. The daughters of this age are in school most of the year, and farm and home activities which they must do depend on the composition of their parental families, as well as the financial status. If there were older brothers and sisters and a small farm, there would doubtless be less for them to do.

Table 48—Kind of Periodicals Subscribed to by White and Negro Families on Poorer and Better Soil

Periodicals	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	No. families with exp.	No. families with exp.	No. families with exp.	No. families with exp.
County papers	52	65	9	13
Daily papers (state)	17	43	4	2
Daily papers (outside state)	1	2	2	1
Farm papers and magazines	36	50	16	5
Women's magazines	16	38	1	1
Religious papers and magazines .....	....	5	3	....
Lodge papers	1	....	....	....
Popular magazines*	6	4	....	....
Magazines of the type of Atlantic Monthly and the like .....	....	1	....	....
Total	52	75	19	13

*As American Magazine, Saturday Evening Post, Liberty.

Table 49—Type of Books in Homes of Whites and Negro Families on Poorer and Better Soil

Type of books	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Per cent	Per cent	Per cent	Per cent
No books	29	21	31	34
School books	50	62	54	51
Bible	47	62	44	45
Religious books	2	9	13	14
Poetry	1	6	1	0
Popular fiction	7	19	2	2
Classical literature	2	5	4	0
Other	8	10	0	5

How did the members of these families spend their time when not engaged in regular farm and home activities? In other words, how did they spend their leisure—reading, visiting, resting, fishing? This information was obtained for all members of these families 8 years and over and is tabulated in Tables 12, 13, 14, 15, 16 and 17 in the Appendix. Possible ways of spending leisure were not listed on the schedule, but the person concerned was asked how he spent his leisure. Some of the ways in which leisure was generally spent were doubtless overlooked. It was observed that what was thought of as a leisure time expenditure by some was regarded as work by others. Leisure was defined as time not spent in regular household or farm tasks, or in eating and sleeping.

In about 80 per cent of the negro homes and 40 per cent of the white homes there was no reading done. No periodicals were subscribed to and the family owned no books, or only a few school books. Members of white families on better soil and negro families on poorer soil read more. They had more education than had members of white families on poorer soil, and negro families on better soil. Then, too, they subscribed somewhat more frequently to periodicals and had a few more books in their homes (Tables 48 and 49). Some of the families borrowed magazines, papers and books. Women and girls read somewhat more often than men and boys. This was true in both white and negro families. The members of white families, of course, read more often than the members of negro families.

This was due to the fact that the members of white families had a better education, and more cash available for purchasing periodicals and books, as well as more opportunities for borrowing the same.

The white families on the better soil with an expenditure for periodicals averaged \$3.79 per family, those on poorer soil \$2.83 per family, while the negro families on the better soil with an expenditure for periodicals averaged \$1.00 per family, those on poorer soil \$1.76 per family. Although the negroes on poorer soil had less cash to spend for reading material, more was spent for this item and a larger amount per family. It is interesting to note that three times as many of the negro families on poorer soil subscribed to farm magazines and papers than those on better soil. Also that four negro families in the poor soil group had classical literature in their homes. Many superior negro families without doubt resided on poorer soil areas, the only kind of land, as a rule, that they can buy.

More than one-half of the families in this study had an expenditure for formal education. White and negro families on better soil areas spent more per family on school supplies and tuition than did those on poorer soil areas. However, (even though the composition of families on the two types of soil was the same) one-fifth more negro families on poorer soil had an expenditure for formal education than negro families on better soil, or to express it differently, more negroes on poorer soil were attempting to give their children an education. Forty-seven per cent of this group were planning to give their sons and daughters a high school education, while only 20 per cent of the negro families on better soil had made such plans for their children (Table 50). White families on better soil were the most ambitious group for their children. They had more cash available for educational purposes. They could, of course, more easily afford to hire labor to assist with farm work and release their children to the school.

Table 50—Plans for Children's Education of White and Negro Families on Poorer and Better Soil*

Plans for education of children	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Per cent	Per cent	Per cent	Per cent
No definite plans	39	21	33	54
Grammar school education	2	1	18	22
High school education	46	47	47	20
College education	13	31	2	4
Total	100	100	100	100

*Includes only families with children in school age.

Table 51—Musical Instruments Owned by White and Negro Families on Poorer and Better Soil

Musical instruments	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Number	Number	Number	Number
Phonograph	16	22	6	23
Organ	10	17	6	7
Piano	3	14	1	1
Radio	5	5	0	0
Guitar	4	10	1	1
Violin	4	6	0	0
Harp	1	0	0	0
Banjo	0	1	0	0
Mandolin	0	1	0	0

Only a few members of the families in this study mentioned music as one of the ways of spending their leisure time. Doubtless in some cases this activity was overlooked. However, the fact that few families owned musical instruments indi-

cates that it could not be a way of spending leisure for many persons in these families (Table 51). The phonograph was the musical instrument most frequently owned. The organ was next in importance. Only 10 families owned a radio, 5 white families on poorer soil and 5 on better soil. Pianos were owned by less than 20 families. Five white families on the poorer soil and 8 on the better soil had an expenditure for music lessons. No negro family had such an expenditure. Negro children in the few families owning organs without doubt learned to pick out their own tunes. A phonograph was the musical instrument most frequently owned by all four groups, though it was owned by negro families on better soil more frequently than by any other group. Negroes enjoy music and usually, as soon as they feel they can afford it, they buy a phonograph, one of the cheapest forms of ready-made music.

Only 5 white families on poorer soil, 31 white families on better soil and 8 negro families on better soil had an expenditure for formal entertainment or recreation, such as movies, script dances, shows, and ball games charging an admission fee, during the year of the study. No negro family on poorer soil had such an expenditure. In the ways of spending leisure secured from the members of these families only 10 sons of white families on better soil mentioned this type of recreation. Without doubt such leisure time expenditures are infrequent in all four groups.

Fishing and hunting were the most frequent forms of outdoor entertainment mentioned by adults. More fished than hunted. Fishing was especially common among negroes. This was for them a family activity, an activity enjoyed by the wife and girls as well as by the husband and boys. In white families fishing was much more commonly done by the husband and boys, less commonly by the mother and girls. In both white and negro families hunting was done by the husband and sons, but not by the wife and daughters. More members of negro families on the poorer soil spent their leisure fishing and hunting, while more members of white families on better soil spent their leisure in this way. Few mentioned swimming as a way of spending leisure time. This may be due to the fact that most of the schedules were taken in cool weather and swimming was not thought of. Horseback riding and bicycling were two activities mentioned by a few sons on better soil areas.

Many of the adults did not engage to any extent in outdoor recreation. In fact, a number reported as their only leisure time expenditure resting or sitting. This expenditure was more often reported by negroes than whites and more often by members of families on better soil, where more farming was done. Farm work is, of course, physically tiring. Therefore, when such work is over many gain more pleasure from sitting or resting than in any other way. The children 8 to 13 years of age in white and colored families engage in games quite generally, though the negro children not quite as often as the white children, and the girls not quite as often as the boys. Few families provided outdoor or indoor play equipment for their children, but the children evidently had enough ingenuity to provide their own games without equipment, for the vast majority reported playing games as the way they used their leisure. A number of boys 14 years and over reported such a use of leisure. However, few girls in this age group reported playing games.

In listing leisure time activities few mentioned affiliations with organizations, but specific questions relating to such activities indicated that one or more members in the majority of homes were affiliated with a church organization (Table 52). More white and negro families on better soil and more negro families than white families attended church. In only 11 negro families and 39 white families was there no member of the family attending church. However, attendance was at times rather irregular. Affiliation with organizations except for the church was almost negligible. Only 18 white families and 9 negro families participated in agricultural extension organizations. Only 20 white families and 4 negro families had agricultural experiment station bulletins. It is a great pity that this group of low income farmers who could so profit from instruction of those employed by the Agricultural College fail to take advantage of such instruction. Indeed, these small

farmers need to be taught to use to the best advantage facilities provided for their benefit.

Table 52—Organizations in Which White and Negro Families on Poorer and Better Soil Were Affiliated

Organizations	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Number	Number	Number	Number
Religious	104	107	118	121
Agricultural extension	7	11	3	6
Other .....	....	7	....	2

The great majority of families in this study demonstrated their interest in the church by making cash contributions for its support as well as by attendance. One hundred and one white families on better soil, 62 white families on poorer soil, and 115 negro families on each soil area made a contribution to the church during 1934. Of those families contributing to the church, an average of \$6.09 was contributed by white families on poor soil, \$12.14 by white families on better soil, \$4.05 by negro families on poorer soil, and \$3.40 by negro families on better soil.²⁶ Although negroes on better soil areas participated in various church activities to a somewhat greater extent than those on poorer areas the families on poorer areas contributed slightly more per capita. Greater participation in church by the groups on better soil areas was no doubt due to the fact that their homes were more accessible to church and also to the fact that they more often had facilities for getting to church. Then, too, families on poorer soil areas were less likely to have the clothing necessary to attend a public gathering.

One of the principal leisure time activities mentioned by the members of these families was visiting. Members of families on better soil visited more than those on poorer soil. Only 25 white families on poorer soil, 33 white families on better soil, 6 negro families on poorer soil and 10 on better soil, owned an automobile. However, farm families are sociable. Many think nothing of walking a mile or two to see a neighbor. Some use wagons as a means of transportation. The members who visited most in both negro and white families were the sons and daughters 14 years and over. Women and girls as a rule visited more often than men and boys.

Quite a number in these families mentioned certain so-called labor activities as ways of spending leisure. Handwork, such as quilting, sewing, knitting, crocheting, and mending were quite frequently mentioned by women and girls. Gardening was mentioned by both men and women as a leisure time activity. Several men spoke of getting wood and care of livestock while several women spoke of care of chickens and flowers. Both mentioned care of children and work about the house as a method of spending leisure. Several of the sons and daughters listed studying as a way leisure was spent. It is, of course, often difficult to distinguish between production and consumption, labor and leisure. However, under most classifications, such activities as the foregoing would be grouped as labor, not leisure.

SOIL FERTILITY ONLY ONE FACTOR IN IMPROVED FAMILY LIVING

In this study were included 125 white and 125 negro families residing on poor soil areas in Winston, Noxubee, and Oktibbeha Counties, Mississippi, and 125 white and 125 negro families of similar family composition on more productive areas in the same counties. The purpose of the study was to describe how the families on these two areas lived. The data were obtained by the schedule method from the family and by the same method from the landlords of those families who were shareworkers.

Analysis of the data thus secured showed families on better soil with greater

²⁶That only 62 of the white families on poorer soil had an expenditure for church would seem to indicate that the church attendance of this group has been exaggerated. See Table 52.

cash income and relatively more of their income derived from the farm. Cash expenditures for family living were likewise greater among those families on more fertile soil.

The greater difference in the manner of living between white families on the two soil areas (where families on the more fertile areas were also more frequently landowners and had more schooling) than in the manner of living between negro families on the two soil areas (where families on the more fertile areas were less frequently landowners and had less schooling) indicates that soil fertility is only one factor affecting the manner in which a farm family lives. The fact that negro families on less productive soil (the group with more landowners and better education) more often had a water supply on their farm, more often had labor-saving equipment, more often subscribed to periodicals and spent more on the education of their children than negro families on more productive soil also seems to bear this out.

Indeed, it would seem that soil fertility is only one of the factors which determine the level of living on any soil. Fertile soil makes greater income possible, and greater income makes a higher level of living possible. Only in this way can the manner in which a family lives be affected by movement from non-productive to productive land. From the data secured in this study it would seem that greater improvement in the level of living of the negro family could be made by movement from poorer to better soil than in the case of the white family.

APPENDIX A—SCORE CARDS

A. Food Supply Score (Yearly)

1. Garden 8

Months	Score
11	7½
10	7
9	6
8	5½
7	5
6	4
5	3½
4	3
3	2

With leafy vegetables 2½

With tomatoes 2½

2. Milk—

1 qt. for children and 1 pt. for adults year around with
required amount 30

Months	Score	Cows give when fresh	Average yield
11	27½	3 gal	2½ gal.
10	25	2½	2
9	22½	2	1
8	20	1½	¾
7	17½	1	½
6	15	¾	¼
5	12½		
4	10		
3	7½		

NOTE: A cow giving milk 10 months during the year, 2 gallons when fresh, would give an average of 1 gallon of milk for 10 months. If the family consisted of 2 adults and 3 children, then their milk score would be 25.

3. Meat (per person)—160 lbs dressed or 200 lbs undressed	10
4. Fruit (per person)—5 trees or vines per person	5
5. Sweet potatoes (3 bu. per person)	5
6. Syrup (3 gal. per person)	5
7. Peanuts and nuts (20 lbs per person) and dried vegetables (peas or beans) 10 lbs or 1/3 bu. per person	5
8. Canned vegetables—40 qts. per person	7
9. Canned fruits—30 qts. per person	5
10. Dried fruits—5 lbs. per person	5
11. Hens—10 per person	10
Total	100

NOTE: Some difference is made in estimating the requirements of families of varying composition in case of items 3 through 11.

B. Food Score Card (Daily)

Milk—	Score
at one meal	10
at two meals	20
at three meals	30

Meat	10
Eggs	10
Syrup (cane or sorghum)	5
Vegetables and fruits—	

Serving of each gives following score:

Potatoes	5
Dried peas, beans, nuts	5
Leafy vegetables	10
Tomatoes or citrus fruits	10
Other vegetables	7
Fresh fruit	7
Dried, cooked or canned fruit	5

NOTE: Give no one more than a score of 45 on fruits and vegetables.

C. Social Status Scale*

Part I.

1. Floor, softwood (6) hardwood (10)
2. Large rug (8)
3. Windows with drapes (each window 2)
4. Fireplace with 3 or more utensils (8)
5. Artificial light; electric (8), kerosene (—2)
6. Table (8)
7. Armchairs (8 each)
8. Desk: personal-social (8)
9. Bookcase** with books (8)
10. Couch pillows (2 each)
11. Periodicals*** (8 each)
12. Newspapers*** (8) each
13. Telephone*** (8)
14. Radio*** (8)

Part II.

15. Cleanliness of room and furnishings:
 - a. Spotted or stained (—4)
 - b. Dusty (—2)
 - c. Spotless and dustless (2)
16. Orderliness of room and furnishings:
 - a. Articles strewn about in disorder (—2)
 - b. Articles in place or in usable order (2)
17. Condition of repair of articles and furnishings:
 - a. Broken, scratched, frayed, ripped, or torn (—4)
 - b. Articles or furnishings patched up (—2)
 - c. Articles or furnishings in good repair and well kept (2)
18. Record your general impression of good taste:
 - a. Bizarre, clashing, inharmonious, or offensive (—4)
 - b. Drab, monotonous, neutral, inoffensive (—2)
 - c. Attractive in a positive way, harmonious, quiet and restful (2)

TOTAL SCORE

*From F. Stuart Chapin. The Measurement of Social Status, pp 6-7, University of Minnesota Press, Minneapolis, 1933. By permission of the University of Minnesota Press, Publishers. This scale, however, differs from Chapin's scale in the four respects mentioned in the text, page 28.

**To be reported if in another room, except professional library of doctor, lawyer, clergyman, teacher, etc.

***To be recorded if in another room.

APPENDIX B

SUPPLEMENTARY TABLES

Table 1—Average Expenditure Per Person for Headwear of White and Negro Families on Poorer and Better Soil

Persons for whom headwear secured*	White families				Negro families			
	Poorer soil		Better soil		Poorer soil		Better soil	
	Number persons	Av. per person	Number persons	Av. per person	Number persons	Av. per person	Number persons	Av. per person
Fathers	71	\$1.84	90	\$1.97	74	\$1.81	76	\$1.37
Mothers	47	1.54	70	1.74	59	1.02	78	1.83
Other men	1	4.00	1	2.30	3	1.41	2	2.25
Other women	3	1.75	4	1.06	2	1.13	5	2.33
Sons 19 years and over	15	2.00	24	2.07	12	1.23	22	1.57
Sons 14-18 years	25	1.30	20	1.42	32	.85	26	1.17
Sons 6-13 years	31	.72	37	.44	50	.86	51	.42
Sons under 6 years	16	.39	30	.32	18	.29	42	.28
Daughters 19 years and over	13	1.68	15	1.85	15	1.96	21	.66
Daughters 14-18 years	7	.97	22	1.08	25	.92	26	.70
Daughters 6-13 years	11	.80	35	.42	22	.49	33	.40
Daughters under 6 years	15	.31	30	.32	21	.47	12	.28

*Only those having this expenditure are included in this tabulation.

Table 2—Average Expenditure Per Person for Outer Garments of White and Negro Families on Poorer and Better Soil

Persons for whom outer garments secured*	White families				Negro families			
	Poorer soil		Better soil		Poorer soil		Better soil	
	Number persons	Av. per person	Number persons	Av. per person	Number persons	Av. per person	Number persons	Av. per person
Fathers	113	\$7.75	120	\$12.93	106	\$7.28	112	\$7.99
Mothers	108	4.65	123	7.52	111	3.60	115	4.84
Other men	1	18.00	1	13.55	4	7.90	3	6.74
Other women	7	4.13	8	3.83	11	2.25	13	7.32
Sons 19 years and over	18	14.92	32	24.42	16	11.48	28	11.46
Sons 14-18 years	38	9.86	34	12.97	44	7.04	41	7.94
Sons 6-13 years	52	5.14	64	6.17	54	3.31	58	4.06
Sons under 6 years	29	3.90	40	3.14	34	2.05	57	1.66
Daughters 19 years and over	20	8.39	23	10.16	18	9.50	33	4.94
Daughters 14-18 years	24	6.68	34	9.33	34	4.42	41	5.10
Daughters 6-13 years	47	3.89	60	4.79	60	1.88	62	2.12
Daughters under 6 years	35	1.95	43	2.85	41	1.22	43	1.38

*Only those having this expenditure are included in this tabulation.

Table 3—Average Expenditure Per Person for Under-Garments of White and Negro Families on Poorer and Better Soil

Persons for whom under-garments secured*	White families				Negro families			
	Poorer soil		Better soil		Poorer soil		Better soil	
	Number persons	Av. per person	Number persons	Av. per person	Number persons	Av. per person	Number persons	Av. per person
Fathers	79	\$1.81	91	\$2.25	73	\$1.75	83	\$1.91
Mothers	92	2.30	115	2.51	95	1.81	102	2.02
Other men	1	2.30	1	3.00	2	1.60	5	1.37
Other women	7	2.36	8	2.23	8	1.29	16	3.06
Sons 19 years and over	13	1.98	28	2.14	14	1.42	24	2.05
Sons 14-18 years	27	1.65	29	1.41	27	1.67	29	1.53
Sons 6-13 years	41	1.25	41	1.49	39	.88	36	1.14
Sons under 6 years	20	1.69	35	1.12	24	.75	43	.84
Daughters 19 years and over	20	1.58	22	3.12	17	3.07	27	1.99
Daughters 14-18 years	22	2.49	34	3.34	33	2.06	37	1.92
Daughters 6-13 years	37	1.23	55	1.69	50	1.08	57	1.02
Daughters under 6 years	27	1.18	42	1.42	37	.78	39	1.05

*Only those having this expenditure are included in this tabulation.

Table 4—Average Expenditures Per Person for Footwear of White and Negro Families on Poorer and Better Soil

Persons for whom footwear secured*	White families				Negro families			
	Poorer soil		Better soil		Poorer soil		Better soil	
	Number persons	Av. per person	Number persons	Av. per person	Number persons	Av. per person	Number persons	Av. per person
Fathers	111	\$4.75	122	\$5.58	103	\$3.95	113	\$4.15
Mothers	116	4.57	124	5.51	113	3.58	119	3.64
Other men	1	7.00	1	8.10	4	4.97	6	3.69
Other women	7	4.18	7	2.41	9	2.74	17	4.03
Sons 19 years and over	17	6.79	33	7.53	17	4.15	26	4.01
Sons 14-18 years	38	4.36	35	4.46	42	3.75	39	3.69
Sons 6-13 years	49	3.04	64	2.93	55	2.11	55	2.28
Sons under 6 years	23	1.92	40	1.66	32	1.22	58	1.24
Daughters 19 years and over	21	6.01	23	6.90	25	5.93	34	3.83
Daughters 14-18 years	24	6.48	34	8.55	53	3.60	43	4.53
Daughters 6-13 years	47	3.68	59	3.95	49	2.42	65	2.57
Daughters under 6 years	35	1.45	43	2.28	40	1.17	44	1.44

*Only those having this expenditure are included in this tabulation.

Table 5—Average Expenditure Per Person for Clothing Accessories of White and Negro Families on Poorer and Better Soil

Persons for whom accessories secured*	White families				Negro families			
	Poorer soil		Better soil		Poorer soil		Better soil	
	Number persons	Av. per person	Number persons	Av. per person	Number persons	Av. per person	Number persons	Av. per person
Fathers	22	\$.52	66	\$1.42	32	\$.47	44	\$.72
Mothers	8	.98	60	.99	23	.39	33	.48
Other men			1	1.36	1	.40	3	.83
Other women	1	.20	2	.15	1	.75	6	.61
Sons 19 years and over	12	.89	27	2.80	6	.96	16	.71
Sons 14-18 years	11	.60	24	.83	16	.65	16	.68
Sons 6-13 years	5	.21	15	.73	12	.24	4	.69
Sons under 6 years	2	.48	3	.27	1	.40	1	.85
Daughters 19 years and over	13	1.00	12	1.00	10	1.01	8	1.40
Daughters 14-18 years	7	.24	20	.78	17	.46	13	.34
Daughters 6-13 years	4	.15	26	.29	15	.14	7	.16
Daughters under 6 years			9	.44	1	.89	3	.67

*Only those having this expenditure are included in this tabulation.

Table 6—Farm and Home Activities Ordinarily Engaged in by the Husbands in White and Negro Families on Poorer and Better Soil

Activity	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Per cent	Per cent	Per cent	Per cent
Butchering	95	89	91	96
Plowing	89	83	93	96
Care of livestock	93	93	92	81
Picking cotton	79	78	91	87
Chopping wood	83	76	84	92
Care of fires	82	83	70	96
Curing meat	80	87	75	87
Hoeing	75	76	78	81
Care of garden	61	61	43	29
Carrying water	45	40	35	31
Making sausage	50	39	31	36
Milking	31	53	31	26
Care of chickens	19	8	9	8
Care of small children	9	2	3	1
Gathering vegetables	2	4	2	5
Cooking	4	0	1	3
Washing dishes	3	2	2	1
Care of milk	3	3	0	1
Churning	4	0	2	1
Washing	3	1	1	0
Care of flowers	2	1	0	0
Ironing	1	1	0	0
Care of lawn	2	0	0	0
Canning	1	0	0	0

Table 7—Farm and Home Activities Ordinarily Engaged in by the Wives in White and Negro Families on Poorer and Better Soil

Activity	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Per cent	Per cent	Per cent	Per cent
Cooking	100	94	95	95
Canning	100	96	92	96
Mending	100	94	97	93
Quilting	92	90	92	93
Washing	87	74	89	80
Sewing	96	91	96	86
Cleaning house	95	94	84	89
Gathering vegetables	94	86	91	89
Care of chickens	91	89	86	92
Care of garden	92	82	93	90
Care of milk	94	94	76	63
Making sausage	86	75	85	79
Churning	90	85	71	63
Washing dishes	83	79	76	75
Care of flowers and lawn	81	72	60	55
Hoeing	43	35	87	92
Picking cotton	40	40	85	90
Ironing	88	73	76	74
Carrying water	60	54	53	54
Milking	75	46	39	38
Care of small children	44	31	29	32
Curing meat	31	20	37	29
Care of fires	29	22	30	30
Butchering	13	5	19	9
Chopping wood	8	2	11	4
Plowing	3	0	3	2
Care of livestock	3	0	1	0

Table 8—Farm and Home Activities Ordinarily Engaged in by Sons 14 Years and Over in White and Negro Families on Poorer and Better Soil

Activity	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Per cent	Per cent	Per cent	Per cent
Plowing	68	82	95	76
Chopping wood	72	78	92	76
Picking cotton	63	85	88	80
Hoeing	65	80	90	77
Care of fires	52	54	78	64
Butchering	35	72	48	52
Care of livestock	45	64	54	39
Milking	40	57	53	33
Carrying water	32	47	47	48
Curing meat	12	32	20	23
Care of garden	27	22	20	12
Making sausage	5	7	5	3
Care of milk	3	4	3	2
Cleaning house	3	0	2	2
Churning	3	0	3	0
Cooking	3	0	0	0
Canning	3	0	0	0
Care of children	2	0	0	0
Care of chickens	0	0	2	0
Gathering vegetables	0	0	0	2
Washing	0	0	2	0
Washing dishes	0	1	0	0
Ironing	0	1	0	0
Care of flowers and lawn	0	1	0	0

Table 9—Farm and Home Activities Ordinarily Engaged in by Daughters 14 years and Over in White and Negro Families on Poorer and Better Soil

Activity	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Per cent	Per cent	Per cent	Per cent
Cleaning house	73	69	76	83
Washing	67	63	78	80
Ironing	67	61	76	83
Canning	67	77	65	63
Picking cotton	45	52	82	89
Hoeing	47	46	84	91
Cooking	59	58	68	71
Care of flowers and lawn	59	63	61	61
Gathering vegetables	51	48	67	52
Quilting	53	48	62	49
Carrying water	53	39	50	69
Sewing	41	55	48	44
Milking	45	35	45	44
Churning	31	34	44	41
Mending	33	39	35	37
Making sausage	41	34	37	25
Care of chickens	37	23	39	29
Care of garden	37	35	15	35
Care of milk	24	26	32	32
Care of fires	16	5	28	21
Care of small children	18	5	18	23
Chopping wood	10	6	6	12
Washing dishes	59	70	77	87
Curing meat	0	2	16	4
Care of livestock	4	0	1	0
Plowing	2	0	1	0
Butchering	0	2	0	0

Table 10—Farm and Home Activities Ordinarily Engaged in by Sons 8 to 13 Years in White and Negro Families on Poorer and Better Soil

Activity	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Per cent	Per cent	Per cent	Per cent
Picking cotton	42	54	76	78
Hoeing	39	56	68	73
Carrying water	50	49	44	68
Chopping wood	50	31	37	54
Care of fires	31	29	34	41
Plowing	22	31	34	24
Milking	31	27	20	17
Care of livestock	12	33	21	22
Butchering	6	22	2	10
Curing meat	8	7	7	0
Care of garden	12	4	5	0
Care of children	8	2	7	0
Washing dishes	14	2	0	0
Making sausage	14	2	0	0
Care of flowers and lawn	3	0	2	10
Care of chickens	6	2	0	5
Churning	8	0	5	0
Gathering vegetables	3	4	2	0
Cleaning house	8	0	0	0
Care of milk	6	0	0	0
Washing	0	0	2	2
Canning	0	0	0	2

Table 11—Farm and Home Activities Ordinarily Engaged In by Daughters 8 to 13 Years in White and Negro Families on Poorer and Better Soil

Activity	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Per cent	Per cent	Per cent	Per cent
Picking cotton	44	47	74	64
Washing dishes	36	77	69	41
Hoeing	39	43	76	61
Carrying water	39	47	62	64
Ironing	54	56	50	41
Cleaning house	44	63	43	48
Care of flowers and lawn	50	53	31	25
Washing	36	40	43	39
Gathering vegetables	19	30	26	14
Care of small children	19	23	26	14
Care of chickens	8	21	17	25
Churning	8	19	12	32
Cooking	14	16	17	23
Canning	22	16	17	14
Care of garden	12	12	31	14
Sewing	6	19	21	11
Care of milk	8	2	14	11
Care of fires	3	9	17	5
Quilting	8	2	17	7
Milking	3	12	7	5
Mending	0	5	10	11
Making sausage	0	5	7	11
Chopping wood	3	0	0	0
Curing meat	0	0	0	2

Table 12—Way Husbands in White and Negro Families on Poorer and Better Soil Spent Leisure*

Way of spending leisure	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Per cent	Per cent	Per cent	Per cent
Resting	20	25	30	51
Reading	38	60	17	4
Fishing	14	19	15	13
Visiting	10	13	17	19
Hunting	12	10	23	13
Repair work	4	2	4	7
Helping around house	0	1	0	12
Walking over place	2	1	6	0
Smoking	5	0	2	1
Playing with children	5	1	1	1
Getting wood	2	0	2	3
Listening to music	3	0	2	0
Church work	0	0	1	1
Whistling	1	0	0	0

*Some listed more than one way.

Table 13—Way Wives in White and Negro Families on Poorer and Better Soil Spend Leisure

Way of spending leisure	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Per cent	Per cent	Per cent	Per cent
Reading	54	50	17	8
Visiting	17	28	18	32
Quilting	11	15	27	26
Resting	12	10	16	26
Sewing	16	16	23	9
Mending	4	3	13	23
Fishing	1	3	15	11
Care of small children	4	4	4	7
Gardening	0	0	0	7
Embroidery work	2	2	1	0
Care of chickens	0	1	0	2
Care of flowers	0	1	0	2
Church work	0	1	0	2
House cleaning	0	0	0	3
Knitting	1	1	0	0
Listening to music	1	0	0	0

Table 14—Way Sons 14 Years and Over in White and Negro Families on Poorer and Better Soil Spend Leisure

Way of spending leisure	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Per cent	Per cent	Per cent	Per cent
Visiting	39	41	28	34
Reading	35	63	10	5
Fishing	26	34	23	16
Hunting	16	19	30	20
Playing games	19	22	20	14
Resting	0	19	20	34
Smoking	3	7	0	0
Horseback riding	0	6	0	2
Quilting	0	0	8	0
Gardening	0	0	5	2
Swimming	0	6	0	0
Movies	0	6	0	0
Cutting wood	0	0	3	2
Listening to music	3	0	0	0
Studying	0	0	3	0
Care of livestock	0	0	0	2
Riding bicycle	0	0	0	2

Table 15—Way Daughters 14 Years and Over in White and Negro Families on Poorer and Better Soil Spend Leisure

Way of spending leisure	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Per cent	Per cent	Per cent	Per cent
Visiting	28	42	36	48
Reading	53	63	20	18
Sewing	9	12	27	14
Resting	9	16	13	18
Quilting	9	5	16	20
Fishing	0	9	24	9
Care of flowers	0	2	9	14
Playing games	6	5	4	4
Care of small children	6	0	4	7
Listening to music	6	9	0	0
Studying	9	0	4	0
Embroidery work	3	7	2	0
House work	0	0	4	5
Mending	3	0	4	2
Gardening	3	0	0	5
Care of chickens	0	2	2	0
Hunting	0	0	2	0

Table 16—Way Sons 8 to 13 Years in White and Negro Families on Poorer and Better Soil Spend Leisure

Way of spending leisure	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Per cent	Per cent	Per cent	Per cent
Playing games	91	87	66	70
Fishing	4	30	21	7
Hunting	0	9	14	4
Visiting	4	0	0	22
Reading	4	17	3	0
Resting	4	0	0	15
Horseback riding	0	13	0	4
Studying	0	0	7	0
Movies	0	4	0	0
Swimming	0	0	3	0

Table 17—Way Daughters 8 to 13 Years in White and Negro Families on Poorer and Better Soil Spend Leisure

Way of spending leisure	White families		Negro families	
	Poorer soil	Better soil	Poorer soil	Better soil
	Per cent	Per cent	Per cent	Per cent
Playing games	76	79	59	52
Reading	20	36	18	4
Visiting	16	11	0	24
Fishing	0	0	20	12
Resting	4	4	6	12
Care of flowers	0	7	6	12
Sewing	0	7	6	4
Quilting	0	0	6	8
Housework	0	0	0	12
Studying	0	0	12	0
Care of small children	0	0	6	0
Care of chickens	4	0	0	0
Crocheting	4	0	0	0

A COMPILATION OF
EXPERIMENTAL DATA

on

COTTON FERTILIZERS

**Applicable to the Hill Sections
of Mississippi**

E. E. GROSS
Coordinator Research Information

Jointly Representing
Mississippi Agricultural Experiment Station
and
Mississippi State Vocational Board

CLARENCE DORMAN, Acting Director
Mississippi Agricultural Experiment Station
State College, Mississippi

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INTRODUCTION

This is a revision of Bulletin 309 compiled by C. F. Clark, Coordinator Research Information and was issued in March 1935.

This revision is an attempt to bring the published fertilizer information up-to-date by completing experiments listed in the original publication and the addition of experiments that have been published since March 1935.

An effort is being made to direct the study of the experiments recorded in this bulletin to a farm management basis. A form is offered to encourage the study of the profit per dollar invested in fertilizer, the dollars invested per farm usually being the limiting factor in regard to the use of fertilizer.

The suggestions and criticisms of Dr. Clarence Donnan of the Mississippi Experiment Station and Professor V. G. Martin and staff of the Agricultural Education Department, Mississippi State College, are appreciated and were very helpful in the revision of the publication.

Form 1—Suggestive Method for Determining the Most Economical Cotton Fertilizer According to Experiments

[illegible]

*Fill in here the average amount of money usually spent annually for cotton fertilizer. In the case of "no fertilizer" use at least as many acres as are used in any fertilizer trial.

***By increasing the fertilizer per acre, fewer acres can be fertilized with the given investment. Credit should be allowed for the use of reduced acres. Estimate the yield per acre according to the yield of cotton on the "no fertilizer" plots. It is suggested that if corn is one of the crops figured on this land, that may be figured also to get a T. D. N. comparison.

****In case of feed crop.

AMOUNTS OF NITROGEN, PHOSPHORUS AND POTASH TO APPLY PER ACRE

The results of experiments immediately following show applications of the three plant nutrients, nitrogen, phosphorus and potash in varying quantities and proportions. Such combinations are usually provided as to hold two of the nutrients constant while one varies. From the results of the one varying, indications may be secured as to the most profitable amount of that nutrient to apply per acre. For instance, 24-48-24, 36-48-24 and 48-48-24 fertilizers may be compared to determine the most profitable amount of nitrogen per acre. The symbol N-P-K represents the pounds of nitrogen, phosphorus and potash, respectively, per acre.

How much nitrogen per acre is most profitable on each of the various soil types? How much phosphorus? How much potash? Use Form 1.

How is the response of cotton to each of the plant nutrients influenced by (1) a cover crop having been grown on the land during the previous winter? (2) the crop being grown in a rotation? (3) weather conditions?

COTTON FERTILIZER EXPERIMENTS IN SOUTH CAROLINA

Conducted by: South Carolina Agricultural Experiment Station in co-operation with farmers of the state.

Conducted at: Bishopville, Trenton and State Park, South Carolina.

Period: State Park, 5 years, 1920, 1923, 1924, 1926 and 1927.

Bishopville, "7 years, 1921-1927.

Trenton, 6 years, 1921-1925 and 1927

Purpose: To determine the amount of various fertilizers best suited for cotton.

Soil: Bishopville—Ruston sandy loam. When the experiment was begun it was in a reasonable fertile condition, although the effect of the fertilizer application was clearly evident from the first.

Trenton—Greenville series. It is a highly developed Coastal Plains soil and at the time this experiment was begun in 1921 the field was in a high state of cultivation, having received very heavy applications of fertilizer in previous years, which probably accounts for the apparent lack of benefit from the application of the mineral fertilizer elements, especially during the first years.

State Park—Norfolk sand, very low in fertility. The drainage is excessive and as a result is often difficult to obtain a stand, and the crop often suffers from drought. Every effort has been made to increase the organic matter content of the soil by turning under numerous cover crops. This has been beneficial, although the yields are still low.

Procedure and Conditions: In all of these tests a regular three-year soil-building rotation has been followed. This consists of cotton the first year, followed by oats and peas or soybeans the second year, and corn with cowpeas or soybeans interplanted the third year. It is the plan of these tests to have one ton of ground limestone applied per acre to one-half of each plot every three years. This has been done wherever possible.

The general plan of the tests, as outlined at the beginning of the work, was to allow for what was believed to be reasonably heavy application of a fertilizer adapted to cotton for the soil in question. Using this as a basis each element in the complete fertilizer was varied in turn, meanwhile keeping the application of the other two constant. In addition in a series of plots the rate of application was increased from nothing to 1400 pounds and in some cases as high as 2,400 pounds per acre, depending upon the soil type and land available for plot work.

From 1920 to 1925 inclusive, fertilizers carrying the same proportions of plant food were applied to all three fertilized crops: to corn at approximately three-fourths of the rate of the cotton applications; and to oats at approximately one-half the rate to cotton. Beginning with 1926, however, the plan of the test was modified so that since that time the corn and oats have received no fertilizer other than uniform applications of readily available form of nitrogen to all plots. It is believed that this is more nearly in accordance

with actual farm practices, and therefore of more benefit to farmers as a whole.

It was also realized in 1926 that the rate of application of nitrogen to cotton was not sufficient for most economical returns, so that beginning with that crop the amount of nitrogen as expressed in the formula was the total applied, two-thirds at planting and the remaining third as a side application shortly after chopping. When the application of ammonia was increased in 1926, the amount as expressed in the formula was all applied prior to planting, and in addition one-half as much more was added as a side application within about two weeks after chopping. This fact should be kept in mind in studying the results.

The source of phosphorus has always been acid phosphate of approximately 16 percent phosphoric acid content, all applied prior to planting. The nitrogen applied before planting has been derived partly from dried blood, as a representative organic source carrying neither phosphorus nor potash, and partly from either nitrate of soda or sulphate of ammonia. The side application of nitrogen has usually been nitrate of soda. Potash has been derived from manure salts or kainit, all applied prior to planting.

In the Coastal Plains test, where level uniform fields are available, check plots receiving a standard rate of application of complete fertilizer were uniformly distributed through the series, every fourth plot being a check plot.

In reporting the yields, only the averages of all check plots in a particular test are given, and these placed where they normally occur in the order of treatments.

Fertilizer: At State Park the fertilizer has been 1,000 pounds per acre of a basic fertilizer analyzing 4-8-4 (6-8-4 since 1926) which includes all the ammonia applied.

The rate of application to cotton at Bishopville has been 600 pounds of complete fertilizer per acre with the basic analysis 4-8-3 (6-8-3 since 1926). This includes a side application of ammonia.

Fertilizer was applied at the rate of 800 pounds per acre of a basic formula 4-8-3 (6-8-3 since 1926) at Trenton. This included all nitrogenous materials applied.

Method of applying fertilizer in relation to the bed: In the furrow below the seed.

Date of applying fertilizer in relation to planting date: One week before planting.

Average planting date: April 20.

Earliest planting date during test: April 15.

Latest planting date during test: April 25.

Variety of cotton used: Cleveland.

Size of plots: 1/10 and 1/20 acre.

Number of replications: Two.

Width of rows: 3½ feet.

The experiment has been run continuously on the same land, each plot following itself each year of the experiment.

Results: Cooperative Fertilizer Experiments at State Park, South Carolina

	Lbs. N-P-K Per Acre	Yield in Lbs. Seed Cotton Per Acre					
		1920	1923	1924	1926	1927	Average
Nitrogen and potash constant							
No phosphorus	33⅓-0-40	361	529	245	398	139	334
2 percent phos. acid	33⅓-20-40	504	724	459	625	243	511
4 percent phos. acid	33⅓-40-40	581	711	417	695	426	566
6 percent phos. acid	33⅓-60-40	618	878	462	709	447	623
8 percent phos. acid	33⅓-80-40	647	859	597	815	631	710
10 percent phos. acid	33⅓-100-40	646	940	537	770	693	717
Phosphorus and potash constant							
No nitrogen	0-80-40	220	285	500	346	168	304
1½ percent nitrogen	16⅔-80-40	189	596	597	519	747	530
3⅓ percent nitrogen	33⅓-80-40	647	859	597	815	631	710
5 percent nitrogen	50-80-40	776	967	455	829	725	750
6⅔ percent nitrogen	66⅔-80-40	495	904	631	697	458	637
Nitrogen and phosphorus constant							
No potash	33⅓-80-0	715	276	218	587	344	430
2 percent potash	33⅓-80-20	722	885	342	1055	582	717
4 percent potash	33⅓-80-40	647	859	597	815	631	710
6 percent potash	33⅓-80-60	472	873	555	957	536	679
Rate of application of complete fertilizer (3⅓-8-4)							
No fertilizer	0-0-0	177	44	293	136	96	149
400 pounds	13⅓-32-16	549	526	529	433	309	469
800 pounds	26⅔-64-32	417	872	525	736	458	602
1000 pounds	33⅓-80-40	647	859	597	815	631	710
1200 pounds	40-96-48	525	1028	672	992	706	785
1600 pounds	53⅓-128-64	536	1287	732	950	851	871

State Park is on about the same latitude as the northern boundary of Mississippi.

Cooperative Fertilizer Experiments at Bishopville, South Carolina

	Lbs. N-P-K Per Acre	Yield in Lbs. Seed Cotton Per Acre							
		1921	1922	1923	1924	1925	1926	1927	Average
Nitrogen and potash constant									
No phosphorus	20-0-18	1270	768	1271	848	836	1590	852	1062
2 percent phos. acid	20-12-18	1212	864	1244	842	873	1525	775	1048
4 percent phos. acid	20-24-18	1170	858	1201	785	828	1790	718	1050
6 percent phos. acid	20-36-18	1307	896	1369	897	923	1915	715	1146
8 percent phos. acid	20-48-18	1325	900	1296	920	928	1870	866	1153
10 percent phos. acid	20-60-18	1318	910	1366	876	906	1852	844	1153
Phosphorus and potash constant									
No nitrogen	0-48-18	800	430	946	425	773	1535	437	764
1½ percent nitrogen	10-48-18	1048	790	1186	808	746	1797	641	1002
2½ percent nitrogen	15-48-18	1065	915	1128	1012	846	1805	707	1068
3½ percent nitrogen	20-48-18	1325	900	1296	920	928	1870	866	1158
4½ percent nitrogen	25-48-18	1315	910	1311	985	963	1710	844	1148
5 percent nitrogen	30-48-18	1435	975	1493	997	1011	1785	948	1235
6½ percent nitrogen	40-48-18	1540	1152	1426	973	971	1820	1053	1277
8½ percent nitrogen	50-48-18	1605	1150	1526	1035	963	1660	1180	1303
Nitrogen and phosphorus constant									
No potash	20-48-0	1487	737	1376	910	986	1718	913	1161
1 percent potash	20-48-6	1410	865	1286	930	1103	1935	938	1210
2 percent potash	20-48-12	1432	928	1276	910	1101	1883	995	1213
3 percent potash	20-48-18	1325	900	1296	920	928	1870	866	1158
4 percent potash	20-48-24	1283	935	1306	883	1011	1842	882	1163
Rate of application of complete fertilizer (3½-8-3)									
No fertilizer	0-0-0	920	430	726	612	743	1725	448	801
200 pounds	6½-16-6	1103	705	1056	808	960	1687	591	987
400 pounds	13½-32-12	1282	834	1166	851	900	1788	764	1084
600 pound	10-48-18	1325	900	1296	920	928	1870	866	1158
800 pounds	26½-64-24	1420	1113	1296	927	993	1865	894	1215
1000 pounds	33½-80-30	1527	1197	1326	933	926	1743	781	1205
1200 pounds	40-96-36	1510	1156	1503	1134	941	1958	880	1297
1400 pounds	46½-112-42	1815	1252	1261	1155	913	1945	1103	1349
1600 pounds	53½-128-48	1840	1238	1498	1063	1006	2173	886	1386

Bishopville is on about the same latitude as the following Mississippi counties: Itawamba, Lee, Pontotoc, Lafayette, Panola, Quitman, and Coahoma.

Cooperative Fertilizer Experiments at Trenton, South Carolina

	Lbs. N-P-K Per Acre	Yield in Lbs. Seed Cotton Per Acre						
		1921	1922	1923	1924	1925	1927	Average
Nitrogen and potash constant								
No phosphorus	26½-0-24	740	1047	1534	1483	1050	1026	1147
2 percent phos. acid	26½-16-24	859	1076	1379	1311	1042	1138	1134
4 percent phos. acid	26½-32-24	897	998	1374	1348	1113	1138	1145
6 percent phos. acid	26½-48-24	814	1070	1444	1341	989	1168	1133
8 percent phos. acid	26½-64-24	807	1080	1429	1363	955	1123	1126
10 percent phos. acid	26½-80-24	822	1206	1024	1340	1030	1097	1086
Phosphorus and potash constant								
No nitrogen	0-64-24	537	855	1126	1071	790	900	881
1½ percent nitrogen	13½-64-24	699	930	1342	1300	903	993	1028
2½ percent nitrogen	20-64-24	919	1084	1418	1367	772	1058	1103
3½ percent nitrogen	26½-64-24	807	1080	1429	1363	955	1123	1126
4½ percent nitrogen	33½-64-24	957	886	1688	1476	708	1105	1133
5 percent nitrogen	40-64-24	845	1076	1528	1495	869	1137	1158
6½ percent nitrogen	53½-64-24	868	972	2046	1423	907	1160	1229
8½ percent nitrogen	66½-64-24	905	916	2360	1483	828	1198	1282
Phosphorus and nitrogen constant								
No potash	26½-64-0	878	1027	1527	1307	899	1056	1116
1 percent potash	26½-64-8	812	1118	1429	1326	978	1130	1132
2 percent potash	26½-64-16	807	1080	1429	1363	955	1123	1126
4 percent potash	26½-64-32	818	1117	1120	1277	917	1058	1051
Rate of application of complete Fertilizer (3½-8-3)								
No fertilizer	0-0-0	657	536	726	1033	940	848	740
200 pounds	6½-16-6	687	826	1106	920	1090	969	933
400 pounds	13½-32-12	736	929	1281	1145	940	1082	1019
600 pounds	20-48-18	793	1102	1311	1318	910	1071	1084
800 pounds	26½-64-24	807	1080	1429	1363	955	1123	1126
1000 pounds	33½-80-30	835	1192	1251	1325	1090	1014	1118
1200 pounds	40-96-36	930	1091	1577	1483	809	1078	1161
1400 pounds	46½-112-42	911	1095	1064	1453	828	1123	1079
1600 pounds	53½-128-48	1012	1218	1165	1603	876	988	1144

The 1926 crop was a complete failure because of late planting and unfavorable moisture conditions.

Trenton is on about the same latitude as the northern tier of Mississippi counties.

Reference: South Carolina Agricultural Experiment Station Bulletin 245, pages 6, 7, 8, 9, 10, 11, and 12, tables 2, 3, and 4, "Cotton Fertilizer Experiments," Clemson, South Carolina.

FERTILIZER EXPERIMENTS WITH COTTON IN ALABAMA

Conducted by: Alabama Agricultural Experiment Station.

Conducted at: Tests were run in 57 counties in Alabama.

Period: 1911-1922.

Purpose: To determine the best fertilizer or combination of fertilizers for cotton on each of the principal soil regions of Alabama.

Soil Types: Norfolk and Greenville of the Lower and Upper Coastal Plain and the Black Belt.

Procedure and Conditions:

Fertilizers: All fertilizers, except nitrate of soda, were applied in the drill before planting. Previous to 1920, the nitrate of soda was applied when the plants were six to eight inches tall. During and since 1920 the nitrate of soda was applied at the first cultivation after cotton was thinned to a stand.

Source of nitrogen: Cottonseed meal containing 7½ % ammonia.

Source of phosphorus: Superphosphate containing 16% phosphoric acid.

Source of potash: Kainit containing 12½ % potassium.

Date of applying fertilizer in relation to planting date: Immediately before.

Earliest planting date during test: Late March in Southern Alabama.

Latest planting date during test: Early May in Northern Alabama.

Size of plots: 1/10 acre.

Width of rows: 3 to 4 feet.

Variety of cotton used: Different farmers used different varieties.

The experiment has not been grown continuously on the same land. No cover crops were grown preceding these experiments. No control measures were used for the boll weevil.

Results of Fertilizer Experiments with Cotton in Alabama

Plot No.	Soil Type	LOWER COASTAL PLAIN						BLACK BELT		UPPER COASTAL PLAIN				
		Number of Experiments		24		64		14	46 experiments in both groups		Norfolk		Greenville	
				Norfolk		Greenville					Norfolk		Greenville	
		Fertilizer per acre Pounds	Pounds N-P-K per acre	Lbs. Yield	Increase over av. No Fert.	Lbs. Yield	Increase over av. No Fert.	Lbs. Yield	Increase over av. No Fert.	Lbs. Yield	Increase over av. No Fert.	Lbs. Yield	Increase over av. No Fert.	Lbs. Yield	Increase over av. No Fert.
1	200 cottonseed meal	12-0-0		542	80	602	126	651	108	637	177	768	183	
2	240 superphosphate	0-38-0		535	73	540	64	658	115	582	122	672	87	
3	No fertilizer	0-0-0		451	.....	453	.....	545	.....	448	.....	564	.....	
4	200 Kainit	0-0-24		606	144	541	65	668	125	588	128	629	44	
5	200 cottonseed meal	12-38-0		650	188	680	204	717	174	725	265	825	240	
6	200 Kainit	12-0-24		714	252	685	209	723	180	715	255	805	220	
7	No fertilizer	0-0-0		475	.....	492	.....	546	.....	469	.....	592	.....	
8	240 superphosphate	0-38-25		655	193	639	163	714	171	647	187	712	127	
9	200 cottonseed meal	12-38-25		803	341	741	265	799	256	782	322	878	293	
10	240 superphosphate	12-38-12		723	261	745	269	773	230	800	340	883	298	
11	No fertilizer	0-0-0		460	.....	482	.....	539	.....	464	.....	600	.....	
12	100 nitrate of soda	15-38-12		763	301	757	281	770	227	805	345	918	333	
	100 Kainit													

Reference: Alabama Agricultural Experiment Station Bulletin 219, tables 1, 3 and 4, "Fertilizer Experiments with Cotton," March 1923, Alabama Polytechnic Institute, Auburn, Alabama.

FERTILIZER EXPERIMENTS WITH COTTON

Conducted by: Alabama Agricultural Experiment Station.

Conducted at: Different sections of Alabama.

Period: 1923-1927.

Purpose: To determine the rate and ratio that nitrate of soda, superphosphate and muriate of potash should be used when applied in greater quantities than the minimum application.

Soil: Houston, Oktibbeha, Greenville and Norfolk.

Procedure and Conditions: The land used for each experiment was selected and measured by a representative of the experiment station. Fertilizers for each plot and instructions concerning their application were sent to each cooperator. Each experiment was inspected one or more times during the growing season.

Fertilizers: All of the fertilized plots in the experiment received a minimum application of 325 pounds of fertilizer per acre, composed of 100 pounds of nitrate of soda, 200 pounds of superphosphate, and 25 pounds of muriate of potash. All the phosphoric acid, all the potash, and one-fourth of the nitrogen were applied in the bed immediately before planting; the remaining $\frac{3}{4}$ of the nitrogen was applied just prior to the first cultivation after the cotton was chopped.

Earliest planting date during test: Late March in South Alabama.

Latest planting date during test: Early May in North Alabama.

Size of plots: $\frac{1}{20}$ acre.

Width of rows: Various widths, usually 3 or $3\frac{1}{2}$ feet.

No cover crops were grown previous to any of these experiments.

The experiments on Houston and Oktibbeha soil were run in Central Alabama while those on Greenville and Norfolk soils were conducted in Central and Southern Alabama.

In the discussion which follows the plot receiving 325 pounds of fertilizer per acre is termed the "base plot" (Plot 2). Any reference to "second increment," "additional material," "additional nitrogen," "phosphoric acid," or "potash" or any similar terms have to do with the additional fertilizer or fertilizing material above that used as the base application. The reader should keep in mind that earlier work reported by this station showed the value of the different fertilizer ingredients used in the base application and that this publication is to record the results of experiments carrying heavier fertilization than the base.

A study of the table will show that there are four possible values for each plant nutrient. For example: the yield of Plot 3 minus the yield on Plot 2 gives the increase due to the second increment of potash alone; the yield of Plot 5 minus the yield on Plot 4 gives the increase due to the second increment of potash in the presence of the second increment of nitrogen; the yield

on Plot 8 minus the yield on Plot 7 gives the values of potash in the presence of a second increment of phosphoric acid, and the yield of Plot 10 minus the yield on Plot 9 gives the value of the second increment of potash in the presence of second increments of both nitrogen and phosphoric acid. By similar calculations four values can also be obtained for phosphoric acid and for nitrogen. In most of the averages of experiment herein recorded the greatest increase due to a single fertilizing element was obtained when the other essential elements were present in the exact proportions as they were used on the base plot. Unless there is a statement to the contrary, any discussion of the value of the increase due to either nitrogen, phosphoric acid, or potash will have reference to their value on Plot 10 and will be obtained as follows:

The yield on Plot 10 minus the yield on Plot 8 equals the value of the second increment of nitrogen.

The yield of Plot 10 minus the yield on Plot 5 equals the value of the second increment of phosphoric acid.

The yield on Plot 10 minus the yield on Plot 9 equals the value of the second increment of potash.

Plot 12 carrying three times the application of the base plot, was added to the experiment in 1924.

Results:

Plot No.	Soil Type		HOUSTON		OKTIBBEHA		GREENVILLE		NORFOLK	
			10		8		34*		45	
	Number of Experiments	Lbs. N-P-K Per Acre	Yield	Increase	Yield	Increase	Yield	Increase	Yield	Increase
1	No fertilizer	0-0-0	696	.....	349	.....	399	.....	354	.....
2	100 lbs. nitrate of soda 200 lbs. superphosphate 25 lbs. muriate of potash	15-32-12	818	122	551	169	710	297	716	360
3	100 lbs. nitrate of soda 200 lbs. superphosphate 50 lbs. muriate of potash	15-32-24	811	115	523	141	724	311	733	377
4	200 lbs. nitrate of soda 200 lbs. superphosphate 25 lbs. muriate of potash	30-32-12	850	154	599	217	839	426	780	424
5	200 lbs. nitrate of soda 200 lbs. superphosphate 50 lbs. muriate of potash	30-32-24	856	160	585	203	854	441	828	472
6	No fertilizer	0-0-0	694	.....	380	.....	413	.....	361	.....
7	100 lbs. nitrate of soda 400 lbs. superphosphate 25 lbs. muriate of potash	15-64-12	821	125	548	166	763	350	761	405
8	100 lbs. nitrate of soda 400 lbs. superphosphate 50 lbs. muriate of potash	15-64-24	880	184	621	239	789	376	770	414
9	200 lbs. nitrate of soda 400 lbs. superphosphate 25 lbs. muriate of potash	30-64-12	880	184	756	374	895	482	833	477
10	200 lbs. nitrate of soda 400 lbs. superphosphate 50 lbs. muriate of potash	30-64-24	866	170	773	391	926	513	913	557
11	No fertilizer	0-0-0	699	.....	418	.....	426	.....	353	.....
Average no fertilizer		0-0-0	696	.....	382	.....	413	.....	356	.....

*Plot 12 on Greenville soil is an average of only 24 experiments.

Reference: Alabama Agricultural Experiment Station Bulletin 228, pages 15, 17, 19 and 21, tables 9, 11, 13, and 15, "Fertilizer Experiments with Cotton," February 1929, Auburn, Alabama.

ANALYSIS TEST WITH COTTON AT YAZOO CITY, MISSISSIPPI

Conducted by: Mississippi Agricultural Experiment Station.

Conducted at: C. C. Swayze's Farm, Yazoo City, Mississippi.

Period: One year.

Purpose: To determine the best analysis for cotton fertilizer.

Soil: Olivier silt loam.

Results:

Analysis Test with Cotton

Analysis	Seed Cotton Per Acre	Increase Over No Fertilizer
500 pounds 6-8-8	1148	616
500 pounds 6-8-4	896	364
500 pounds 6-8-12	1112	580
500 pounds 6-8-0	516	-16
500 pounds 4-8-8	1076	544
500 pounds 8-8-8	1120	588
500 pounds 0-8-8	776	244
500 pounds 6-4-8	1100	568
500 pounds 6-12-8	1036	504
No fertilizer	532	

Reference: Mississippi Agricultural Experiment Station Information Sheet 124, "Cotton Fertilizers—Rates and Analysis," November 1937, State College, Mississippi.

FERTILIZER ANALYSIS TEST WITH COTTON AT RAYMOND, MISSISSIPPI

Conducted by: Raymond Branch Experiment Station.

Conducted at: Raymond, Mississippi.

Period: 1925-1935.

Purpose: To determine the best analysis for cotton fertilizer.

Soil: Olivier silt loam.

Land History: It is said that the land on which this test was run has been in cultivation about 80 years.

Procedure and Conditions:

Fertilizer used:

Source of nitrogen: Chilean nitrate of soda.

Source of phosphorus: Superphosphate.

Source of potash: Muriate of potash.

Method of applying fertilizer: Put in bottom of water furrow and bedded on.

Dates of applying fertilizer: 1926, April 11; 1927, April 18; 1928, April 19; 1929, April 13; 1930, April 16; 1931, April 11; 1933, April 28; 1934, April 13.

Dates of planting: 1925, May 14; 1926, April 17; 1927, April 20; 1928, April 21; 1929, April 19; 1930, April 23; 1931, April 17; 1933, May 31; 1934, April 19.

Spacing of plants in drill: Two stalks in hills a foot apart.

Size of plots: 1/20 acre.

Width of rows: 3½ feet.

Number of replications: 3.

Variety of cotton used: 1925-31, Lone Star 65; 1933-34, Starfos*.

Good stands were secured practically every year. Cotton was always poisoned when needed, too late in 1934, however.

Results:

Fertilizer Analysis Test with Cotton at Raymond, Mississippi

Pounds N-P-K Per Acre	Equivalent to 600 lbs. Per Acre	Increase over no fertilizer in pounds seed cotton per acre										
		1925	1926	1927	1928	1929	1930	1931	1933	1934	1935	Average
		Varying Analysis (Rate 600 pounds per acre)										
24-48-48	4-8-8	374	516	758	483	411	500	554	664	290	260*	481
24-48-36	4-8-6	255	470	657	551	507	510	673	629	330	303	489
24-48-24	4-8-4	224	425	498	401	536	399	597	632	358	293	436
24-48-12	4-8-2	311	470	519	323	462	384	607	546	308	219	415
24-48-0	4-8-0	351	383	286	247	241	198	516	395	239	215	307
48-48-24	8-8-4	493	696	688	545	593	646	746	807	487	364	607
36-48-24	6-8-4	464	507	604	578	583	601	773	826	417	310	566
24-36-24	4-6-4	510	562	543	481	477	550	755	596	398	230	510
24-24-24	4-4-4	303	424	527	467	562	503	623	610	389	178	458
	Equivalent to 4-8-4 at the rate of											
48-96-48	1200 lbs.	638	657	938	846	1061	992	1145	1253	628	520	868
72-144-72	1800 lbs.	828	1162	1100	924	1127	966	1203	1318	802	544	997
96-192-96	2400 lbs.	741	1330	1056	1273	1242	1090	1017	1535	638	583	1050
Yield without fertilizer		1465	1021	901	544	756	976	823	896	541	481	840

*Entire plot severely damaged by flood of May 19. The 1935 data is the result of salvaging the remaining portion not washed.

No experiment in 1932 due to lack of funds with which to buy fertilizer.

Reference: Annual reports of the station.

*Starfos is a cross between Lone Star 65 and Delfos 6102.

FERTILIZER ANALYSIS TEST ON COTTON AT STATE COLLEGE,
MISSISSIPPI

Conducted by: Mississippi Agricultural Experiment Station.

Conducted at: Farm of G. Yeates, Starkville, Mississippi.

Period: 1926-1937.

Purpose: To determine the best analysis for cotton fertilizer.

Soil: Lufkin clay loam.

Procedure and Conditions:

Fertilizer used: Sodium nitrate, superphosphate, muriate of potash.

Method of applying fertilizer: In water furrow by hand and bedded on.

Width of rows: $3\frac{1}{2}$ feet.

Size of plots: $\frac{1}{20}$ acre.

Fertilizer Analysis Test on Cotton

Pounds N-P-K Per-Acre	Equivalent to 600 lbs. per acre of	Increase Over no Fertilizer in Pounds Seed Cotton Per Acre												
		1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	Average
24-48-48	4-8-8	385	535	118	580	279	421	278	227	335	48	402	375	334
24-48-36	4-8-6	385	440	90	559	268	440	226	177	410	87	450	300	321
24-48-24	4-8-4	352	473	85	526	220	489	329	172	423	123	446	311	328
24-48-12	4-8-2	288	369	30	450	146	511	304	223	399	132	304	294	283
24-48-0	4-8-0	327	410	36	468	85	479	283	198	288	183	250	212	267
48-48-24	8-8-4	548	703	148	839	205	757	489	196	262	276	555	507	454
36-48-24	6-8-4	419	614	94	741	228	613	428	264	310	207	390	389	388
24-36-24	4-6-4	337	517	81	513	214	480	337	214	240	258	405	302	322
24-24-24	4-4-4	250	438	50	414	132	415	320	181	286	243	295	269	270
	Equivalent to 4-8-4 at the rate of													
48-96-48	1200 lbs.	537	866	240	975	345	765	63*	387	349	300	615	573	536**
72-144-72	1800 lbs.	625	1144	341	1101	434	844	61*	356	432	441	786	735	654**
96-192-96	2400 lbs.	791	1323	557	1257	494	927	106*	396	446	426	814	808	745**
Yield without fertilizer		273	568	49	482	360	153	226	94	193	390	506	391	307

*Residual effect.

**11 year average.

Reference: Mississippi Agricultural Experiment Station Information Sheet 135, "Cotton Fertilizer—Lufkin Clay," December 1937, State College, Mississippi.

FERTILIZER ANALYSIS TEST WITH COTTON AT STATE COLLEGE, MISSISSIPPI

Conducted by: Mississippi Agricultural Experiment Station.

Conducted at: State College, Mississippi.

Period: 1925-1937.

Purpose: To determine the best analysis for cotton fertilizer.

Soil: Ochlockonee fine sandy loam.

Procedure and Conditions:

Fertilizer used: Sodium nitrate, superphosphate, muriate of potash.
The nitrogen fertilizer has been varied.

Method of applying: In water furrow by hand and bedded on.

Date of planting: April 25, approximately.

Size of plots: 6 rows, 95 feet long.

Width of rows: 3½ feet.

Fertilizer Analysis Test with Cotton at State College, Mississippi

Pounds N-P-K Per Acre	Equivalent to 600 Lbs. Per Acre	Increase over no fertilizer in pounds seed cotton per acre												1925-37 Average
		1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937
24-48-48	4-8-8	286	288	692	609	582	601	177	510	593	351	386	868	1199
24-48-36	4-8-6	319	208	640	526	554	586	203	465	541	354	346	904	1136
24-48-24	4-8-4	254	234	578	605	521	529	234	360	507	288	310	667	922
24-48-12	4-8-2	189	171	411	361	325	269	.....	.....	.....	.....	.....	.....	288*
24-48-0	4-8-0	-12	12	54	73	4	92	86	-27	230	103	119	175	92
48-48-24	8-8-4	226	104	469	395	335	513	.....	.....	.....	.....	.....	.....	346*
36-48-24	6-8-4	272	168	504	512	405	469	.....	.....	.....	.....	.....	.....	388*
24-36-24	4-6-4	223	138	528	465	376	515	.....	.....	.....	.....	.....	.....	374*
24-24-24	4-4-4	165	130	511	405	295	483	.....	.....	.....	.....	.....	.....	130*
24-48-72	4-8-12	.....	.....	.....	.....	.....	.....	266	529	585	377	363	756	1358
48-48-48	8-8-8	.....	.....	.....	.....	.....	.....	141	427	613	427	419	825	1313
36-48-48	6-8-8	.....	.....	.....	.....	.....	.....	168	610	565	390	386	680	1329
24-36-48	4-6-8	.....	.....	.....	.....	.....	.....	201	652	537	450	356	669	1395
24-24-48	4-4-8	.....	.....	.....	.....	.....	.....	185	638	557	443	340	676	1422
48-96-48	1200 lbs.	633	272	841	760	472	673	.....	.....	.....	.....	.....	.....	608*
72-144-72	1800 lbs.	649	223	810	656	514	780	.....	.....	.....	.....	.....	.....	608*
96-192-96	2400 lbs.	549	228	880	614	382	899	.....	.....	.....	.....	.....	.....	592*
48-96-96	1200 lbs.	.....	.....	.....	.....	.....	.....	186	643	667	449	528	412	1533
72-144-144	1800 lbs.	.....	.....	.....	.....	.....	.....	-12	577	662	302	551	449	1619
96-192-192	2400 lbs.	.....	.....	.....	.....	.....	.....	20	509	493	365	511	172	1295
No fertilizer		560	370	877	602	395	590	444	704	320	735	604	1198	472

*Six-year average.

**Seven-year average.

Reference: Mississippi Agricultural Experiment Station Information Sheet 136, "Rates and Analysis Test on Ochlockonee Fine Sandy Loam on Experiment Station Farm, Results 1925-1937," December 1937, State College, Mississippi.

**FERTILIZER ANALYSIS TEST ON COTTON (VALLEY LAND)
HOLLY SPRING, MISSISSIPPI**

Conducted by: Holly Springs Branch Experiment Station.

Conducted at: Holly Springs, Mississippi.

Period: 1925-1937.

Purpose: The purpose of this experiment was to determine the best analysis for cotton fertilizers.

Soil: Lintonia silt loam, improved valley land.

Procedure and Conditions:

Fertilizer used:

Source of nitrogen: Nitrate of soda containing 15% and 16% nitrogen. The 16% nitrogen in 1934.

Source of phosphorus: Superphosphate containing 16% and 20% phosphoric acid.

Source of potash: Muriate containing 50% potassium.

Date of applying fertilizer: A few days prior to planting.

Earliest planting date during test: April 22, 1926.

Latest planting date during test: May 28, 1927.

Average planting date: April 29.

Size of plots 1/20 acre repeated 3 times.

Width of rows: 3½ feet.

Number of replications: 3.

Variety of cotton used: 1925, Delfos 6102; 1926, Lone Star 65; 1927, Miss. Station Trice; 1928, Delfos 1341.

The experiment has been run continuously on the same land, each plot following itself each year of the experiment. Legumes have been grown each year since 1910. Boll weevil control measures were used.

Results: Fertilizer Analysis Test on Cotton (Valley Land) Holly Springs, Mississippi

Lbs. N-P-K Per Acre	Equivalent to 600 lbs. Per acre	Increase over no fertilizer in pounds seed cotton per acre												1925-1937 Average
		1925	1926	1927	1928	1929	1930	1931	1933	1934	1935	1936	1937	
24-48-48	4-8-8	435	908	372	812	1070	859	174	1096	760	566	756	1183	749
24-48-36	4-8-6	316	758	265	817	936	696	60	1034	788	616	789	1206	690
24-48-24	4-8-4	586	538	244	595	821	589	82	753	590	504	686	1101	590
24-48-12	4-8-2	238	363	319	270	553	488	0	393	506	481	434	646	390
24-48-0	4-8-0	170	115	269	61	139	197	-47	-37	260	234	137	192	140
48-48-24	8-8-4	361	524	250	458	789	639	16	661	694	687	653	806	545
36-48-24	6-8-4	475	519	382	597	709	633	52	742	674	611	664	884	578
24-36-24	4-6-4	271	373	285	533	686	603	179	654	697	474	600	1048	550
24-24-24	4-4-4	423	291	274	393	476	554	76	734	674	497	530	790	475
	Equivalent to 4-8-4 at the rate of													
48-96-48	1200 lbs.	774	738	433	760	791	782	48		630	725	690	990	669
72-144-72	1800 lbs.	739	834	167	894	1021	959	-48						651*
96-192-96	2400 lbs.	484	1058	99	1081	1197	1061	-68						701*
Yield without fertilizer		1561	1213	824	786	763	714	390	895	912	723	1000	1005	899

*Seven year average.

In 1932 the test was not run due to lack of funds for purchasing fertilizer.

Reference: Mississippi Agricultural Experiment Station Information Sheet 133, "Fertilizer Rates and Analysis Test," December 1937, State College, Mississippi.

**FERTILIZER ANALYSIS TEST ON COTTON (HILL LAND)
HOLLY SPRINGS, MISSISSIPPI**

Conducted by: Holly Springs Branch Experiment Station.

Conducted at: Holly Springs, Mississippi.

Period: 1925-1937.

Purpose: To determine the best analysis for cotton fertilizers.

Soil: Unimproved Grenada silt loam underlain by Wilcox sand that has been in cultivation for 75 years.

Procedure and Conditions:

Fertilizers:

Source of nitrogen: Nitrate of soda containing 15% and 16% nitrogen.

Source of phosphorus: Superphosphate containing 16% and 20% phosphoric acid.

Source of potash: Muriate containing 50% potash.

Method of applying fertilizer: In list opened.

Date of applying fertilizer: Shortly before planting, 6 or 7 days.

Date of planting:

Earliest planting date during test: April 25, 1930.

Latest planting date during test: May 15, 1933.

Average planting date: May 7.

Size of plots: 1/20 acre repeated 3 times. Each plot consisted of four rows but only the two middle rows were used in recording results.

Width of rows: 3 feet.

Variety of cotton used: 1925, Miss. Station Trice; 1926-27-28, Lone Star 65; 1928-30, Stoneville No. 2; 1930 to 1934, Stoneville No. 3.

The experiment has been run continuously on the same land.

Fertilizer Analysis Test with Cotton (Hill Land) Holly Springs, Mississippi

Results:

Lbs. N-P-K Per Acre	Equivalent to 600 lbs. Per acre	Increase over no fertilizer in pounds seed cotton per acre													1925-1937 Average
		1925	1926	1927	1928	1929	1930	1931	1933	1934	1935	1936	1937		
24-48-48	4-8-8	541	892	691	388	516	193	528	589	332	399	274	393	478	
24-48-36	4-8-6	542	1083	672	414	472	205	536	558	301	418	285	398	490	
24-48-24	4-8-4	465	1011	747	328	426	259	594	669	288	401	289	398	490	
24-48-12	4-8-2	238	782	515	310	424	183	504	779	332	373	342	422	434	
24-48-0	4-8-0	190	486	613	200	354	194	492	666	260	366	279	324	369	
48-48-24	8-8-4	292	1693	701	314	402	375	788	940	353	531	328	487	550	
36-48-24	6-8-4	272	493	645	303	455	346	816	872	331	481	302	519	487	
24-36-24	4-6-4	263	498	650	235	384	289	452	761	275	412	292	449	413	
24-24-24	4-4-4	281	446	481	220	343	299	350	691	188	383	295	445	368	
24-60-48	4-10-8								622	327	434	416	496	459*	
24-72-48	4-12-8								703	282	420	404	425	447*	
24-48-60	4-8-10								593	262	395	376	393	404*	
24-48-72	4-8-12								670	272	401	423	398	433*	
	Equivalent to 4-8-4 at the rate of														
48-96-48	1200 lbs.	622	703	924	495	583	401	1106	1006	430	577	354	621	652	
72-144-72	1800 lbs.	801	905	1038	496	613	381	1230						780**	
96-192-96	2400 lbs.	985	946	1035	542	636	393	1476						859**	
Yield without fertilizer		689	609	672	562	642	495	288	382	550	479	565	563	540	

*Five-year average.

**Seven-year average.

Reference: Mississippi Agricultural Experiment Station Information Sheet 134, "Fertilizer Rates and Analysis Tests," December 1937, State College, Mississippi.

FERTILIZER ANALYSIS TEST ON COTTON — COOPERATIVE TESTS WITH JUNIOR COLLEGES

Conducted by: Mississippi Agricultural Experiment Station.

Conducted at: East Mississippi Junior College, Scooba, Mississippi, and Southwest Junior College, Summit, Mississippi.

Period: 1937.

Purpose: To determine the best analysis for cotton fertilizer.

Soil: Lufkin fine sandy loam at Scooba, Mississippi, and Caddo very fine sandy loam at Summit, Mississippi.

Results:

Fertilizer Analysis Test on Cotton—Cooperative Tests

Analysis	East Mississippi Jr. College Scooba, Mississippi		Southwest Junior College Summit, Mississippi	
	Yield Seed Cotton Per Acre	Increase Over No Fertilizer	Yield Seed Cotton Per Acre	Increase Over No Fertilizer
600 lbs. 4-8-4	954	400	881	651
600 lbs. 4-8-0	765	211	531	301
600 lbs. 4-8-8	1116	562	1112	882
600 lbs. 4-8-12	1053	499	1184	954
600 lbs. 0-8-4	765	211	770	540
600 lbs. 6-8-4	972	418	954	724
600 lbs. 8-8-4	959	405	945	715
600 lbs. 4-4-4	878	324	725	495
600 lbs. 4-12-4	1075	521	878	648
600 lbs. 4-0-4	850	296	567	337
No fertilizer	554		230	

Reference: Mississippi Agricultural Experiment Station Information Sheet 122, "Fertilizer Rates and Analysis Test—Cotton—Cooperative Tests with Junior Colleges," November 1937, State College, Mississippi.

NITRATE OF SODA RATES TEST WITH COTTON AT NATCHEZ, MISSISSIPPI

Conducted by: Natchez Branch Experiment Station.

Conducted at: Natchez, Mississippi.

Period: 1930-1937.

Purpose: To determine the best rate of applying nitrate of soda to cotton.

Procedure and Conditions: Nitrate of soda was applied under cotton before planting.

Results

Nitrate of Soda Rates Test with Cotton, Natchez, Mississippi

Treatment	Yield in Pounds Seed Cotton Per Acre						
	1930	1931	1934	1935	1936	1937	Average
Check—no nitrate of soda	124	188	165	211	303	343	222
100 lbs. nitrate of soda	179	275	205	307	448	541	326
150 lbs. nitrate of soda	221	370	234	323	464	592	367
200 lbs. nitrate of soda	234	406	273	378	556	692	423
250 lbs. nitrate of soda	224	428	322	342	562	641	420
300 lbs. nitrate of soda	231	489	320	382	562	609	432

Reference: Mississippi Agricultural Experiment Station Information Sheet 141, "Cotton Fertilization," January 1938, State College, Mississippi.

FERTILIZER RATES TEST RUN IN COOPERATION WITH TEACHERS OF VOCATIONAL AGRICULTURE

Conducted by: Mississippi Agricultural Experiment Station in cooperation with Vocational Agriculture Teachers.

Conducted at: Caledonia, Hickory Flat, Lake, Dumas, Duck Hill and Edinburg, Mississippi.

Period: 1936.

Purpose: To determine the best rate of applying fertilizer to cotton.

Soil: Savannah silt loam, Ruston fine sandy loam, Montrose clay, Collins silt loam and Kalmia fine sandy loam.

Results

Rates Test with Cotton Run in Cooperation with Teachers of Vocational Agriculture

Treatment	Pounds seed cotton per acre increase over no fertilizer						
	1	2	3	4	5	6	Average
100 pounds 6-8-4	130	162	-144	236	78	184	108
200 pounds 6-8-4	120	222	44	332	99	160	163
400 pounds 6-8-4	260	392	64	432	323	334	284
600 pounds 6-8-4	320	612	24	510	303	406	362
800 pounds 6-8-4	240	634	-8	494	273	394	388
1200 pounds 6-8-4	400	778	44	422	375	692	452
No fertilizer (total yield)	1580	888	1216	234	1187	716	970

1. E. H. McCaleb, Caledonia—Savannah silt loam.
2. R. L. Barrett, Hickory Flat—Ruston fine sandy loam.
3. G. A. Noel, Lake—Montrose clay.
4. J. M. Ferguson, Dumas—Type undetermined.
5. B. M. Trapp, Duck Hill—Collins silt loam.
6. N. J. Smith, Edinburg—Kalmia fine sandy loam.

Reference: Mississippi Agricultural Experiment Station Information Sheet 124, "Cotton Fertilizers—Rates and Analysis," November 1937, State College, Mississippi.

RATES TEST WITH COTTON AT YAZOO CITY, MISSISSIPPI

Conducted by: Mississippi Agricultural Experiment Station.

Conducted at: C. C. Swayze's Farm, Yazoo City, Mississippi.

Period: One year.

Purpose: To determine the best rate of applying fertilizer to cotton.

Soil: Olivier silt loam.

Results:

Rates Test with Cotton

Rates	Seed Cotton Per Acre	Increase Over No Fertilizer
100 pounds 6-8-8	740	208
300 pounds 6-8-8	868	336
500 pounds 6-8-8	1148	616
700 pounds 6-8-8	1212	689
900 pounds 6-8-8	1264	732
1200 pounds 6-8-8	1268	736
500 pounds 6-8-8 and 500 pounds Dolomitic limestone	1200	668
No fertilizer	532	

Reference: Mississippi Agricultural Experiment Station Information Sheet 124, "Cotton Fertilizers—Rates and Analysis," November 1937, State College, Mississippi.

RATES TEST WITH COTTON AT EAST CENTRAL JUNIOR COLLEGE, DECATUR, MISSISSIPPI

Conducted by: Mississippi Agricultural Experiment Station.

Conducted at: East Central Junior College, Decatur, Mississippi.

Period: 1937.

Purpose: To determine the best rate of applying fertilizer.

Soil: Kirvin fine sandy loam.

Results:**Rates Test with Cotton at Decatur, Mississippi**

Rates	Seed Cotton Per Acre	Increase Over No Fertilizer
100 pounds 6-8-4	765	126
200 pounds 6-8-4	892	253
400 pounds 6-8-4	1161	522
600 pounds 6-8-4	1233	594
800 pounds 6-8-4	1148	509
1000 pounds 6-8-4	1350	711
No fertilizer	639	

Reference: Mississippi Agricultural Experiment Station Information Sheet 122, "Fertilizer Rates and Analysis Test—Cotton—Cooperative Tests with Junior Colleges," November 1937, State, College, Mississippi.

**THE EFFECT OF VARIOUS FERTILIZERS ON COTTON PLANTED ON
FOUR SOIL TYPES IN ALABAMA**

Conducted by: Alabama Agricultural Experiment Station.

Conducted at: Black Belt Substation, Marion Junction, Alabama.

Period: 1930-1936.

Purpose: To determine the effect of various fertilizers on cotton when planted on different soil types.

Soil: Houston and Sumter (Lime soils).

Vaiden and Eutaw (Acid soils).

Procedure and Conditions: The experiments were not conducted in rotation; many of the crops were planted continuously on the same plots. The phosphate and potash were always applied at planting; the nitrogen was applied one-fourth at planting and three-fourths as a side dressing at the first cultivation.

The lime soils do not seem to be as well suited for cotton as the acid soils.

Results:

Effect of Various Fertilizers on Cotton When Planted on Four Soil Types of Alabama

Fertilizer—Lbs. Per Acre			Yield in Pounds Seed Cotton Per Acre			
Nitrate of soda	Super- phosphate	Muriate of potash	Houston clay	Sumter clay	Vaiden clay	Eutaw clay
			1932-36	1933-36	1931-36	1933-36
	None		353	181	292	479
0	375	50	571	468	549	958
225	0	50	389	313	149	451
225	375	0	469	202	630	1038
225	375	50	624	509	733	984
225	750	50	669	549	850	1282
225	750	50L*	.....	.....	934	1218

*Two tons per acre of ground limestone 1930 on Vaiden clay and 1931 on Eutaw clay.

Reference: Alabama Agricultural Experiment Station Circular 78, pages 4, 5, 19, 20, 21 and 22, tables 1, 2, 3, and 4, "Fertilizer and Crop Experiments on Certain Soils of the Black Belt," July 1937, Auburn, Alabama.

RATE OF FERTILIZER APPLICATION ON COTTON AT TIFTON, GEORGIA

Conducted by: Georgia Coastal Plain Experiment Station.

Conducted at: Tifton, Georgia.

Period: 1924-1933.

Purpose: To compare the varying rates of applying fertilizer on the yield of cotton.

Soil: The cotton work at Tifton, Georgia experiment station has been largely on a typical Tifton sandy loam with work also being done on a light phase of Tifton sandy loam which very closely resembles Norfolk sandy loam. The results of this work, therefore, should be applicable to both Tifton and Norfolk soil types.

Procedure and Conditions:

Fertilizer:

Source of nitrogen: Nitrate of soda, containing 15% nitrogen.

Source of phosphorus: Superphosphate containing 16% phosphoric acid.

Source of potash: Muriate of potash containing 50% potash.

Date of applying fertilizer in relation to planting date: Ten to 14 days before planting.

Method of applying fertilizer in relation to the bed: Applied to furrow and bedded on.

Average planting date: April 1.

Size of plot: 1/20 acre.

Width of rows: 3.3 feet.

Number of replications: Four.

Boll weevil control measures used: Mopped once using about 2 pounds calcium arsenate per acre.

The experiment has not been run continuously on the same land.

Results: Rate of Fertilizer Application Test on Tifton Sandy Loam, Tifton, Georgia

Pounds N-P-K Per Acre	Equivalent to 2½-9-5 at rate of	Yield in Pounds Seed Cotton Per Acre										Average
		1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	
0-0-0	None	338	306	350	312	264	308	255	270	546	687	364
7½-27-15	300 pounds	685	565	722	472	646	949	425	577	856	967	686
15-54-30	600 pounds	822	931	882	717	783	1055	598	850	1142	1236	902
22½-81-45	900 pounds	1145	1212	.....	984	1052	1162	784	1023	1216	1291	1097*
30-108-60	1200 pounds	.....	1528	1044	1653	1148	1284	988	1168	1382	1556	1239**

*Nine year average 1924-1925, 1927-1933.

**Nine year average 1925-1933.

Reference: Georgia Coastal Plain Experiment Station Bulletin 13, page 18, "Cotton Production in the Coastal Plain of Georgia," June 1930, Tifton, Georgia, and Georgia Coastal Plain Experiment Station Bulletin 24, page 16, table 4, "Fourteenth Annual Report," June 1934, Tifton, Georgia.

Tifton, Georgia, is located on about the same latitude as the following Mississippi counties: Adams, Franklin, Lincoln, Lawrence, Jefferson Davis, Covington, Jones and Wayne.

NITRATE OF SODA SIDE-DRESSING FOR COTTON IN GEORGIA

Conducted by: Georgia Coastal Plain Experiment Station.

Conducted at: Tifton, Georgia.

Period: 1924-1934.

Purpose: To determine the increase in yield that may be obtained from varying amounts of nitrate of soda applied as a side-dressing.

Soil: The cotton work at the Georgia Experiment Station has been largely on a typical sandy loam with work also being done on a light phase of Tifton sandy loam which closely resembles Norfolk sandy loam. The results of this work, therefore, should be applicable to both Tifton and Norfolk soil types.

Procedure and Conditions:

Fertilizer: The cotton received 600 pounds of a 2½-9-3 fertilizer at planting, the side dressing being applied a few days before the first squares appeared.

Source of nitrogen: Nitrate of soda containing 15% nitrogen.

Source of phosphorus: Superphosphate containing 16% phosphoric acid.

Source of potash: Muriate containing 50% potash.

Date of applying fertilizer in relation to planting date: Ten to 14 days before planting.

How was fertilizer applied in relation to the bed: Applied in furrow and bedded on. Fertilizer about three inches below seed.

Average planting date: April 1.

Variety of cotton used: Petty Toole.

Results:

Nitrate of Soda Side-Dressing Test on Tifton Sandy Loam

Pounds Nitrate of Soda Side Dressing	Fertilizer Per Acre			Yield in Pounds Seed Cotton Per Acre										
	Lbs. N-P-K from		Total											
	Original Application 600 Lbs. 2½-9-5	Side Dressing		1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	Average
None	15-54-30	None	15-54-30	606	438	844	801	475	1400	846	851	1029	1080	837
50	15-54-30	7½-0-0	22½-54-30	701	364	997	800	560	1519	949	928	1153	1282	925
100	15-54-30	15-0-0	30-54-30	888	627	1146	950	605	1518	944	975	1091	1613	1036
150	15-54-30	22½-0-0	37½-54-30	1024	668	1104	1050	615	1677	983	1115	1211	1567	1101
200	15-54-30	30-0-0	45-54-30	900	613	1149	973	623	1800	1008	1166	1291	1598	1112

Reference: Georgia Coastal Plain Experiment Station Bulletin 24, page 18, table 7, Sixteenth Annual Report of the Station, September 1936, Tifton, Georgia.

Tifton, Georgia is located on about the same latitude as the following Mississippi counties: Adams, Franklin, Lincoln, Lawrence, Jefferson Davis, Covington, Jones, and Wayne.

POTASH SIDE-DRESSING FOR COTTON IN TIFTON, GEORGIA

Conducted by: Georgia Coastal Plain Experiment Station.

Conducted at: Tifton, Georgia.

Period: 1929-1936.

Purpose: To determine the effect of varying amounts of potash applied to cotton as a side-dressing.

Soil: The cotton work at the Georgia experiment station has been largely on a typical Tifton sandy loam with work also being done on a light phase of Tifton sandy loam which very closely resembles Norfolk sandy loam. The results of this work, therefore, should be applicable to both Tifton and Norfolk soil types.

Procedure and Conditions:

Fertilizer: The cotton was fertilized with 600 pounds of a 9-5-3 at the time of planting, and was top-dressed with muriate of potash when the first squares appeared.

Source of nitrogen: Nitrate of soda containing 15% nitrogen.

Source of phosphorus: Superphosphate containing 16% phosphoric acid.

Source of potash: Muriate containing 50% potassium.

Date of applying fertilizer in relation to the bed: Ten to 14 days before planting.

How fertilizer was applied in relation to bed: Applied to furrow, bedded on. Side-dressed at time of appearance of first squares.

Average planting date: April 1.

Size of plots: 1/20 acre.

Width of rows: 3.3 feet.

Number of replications: Two.

Boll weevil measures used: About 2 pounds calcium arsenate per acre.

Results:

Potash Side-Dressing Test with Cotton

Fertilizer Per Acre				Yield in Pounds Seed Cotton Per Acre							
Pounds Potash Side Dressing	Lbs. N-P-K from		Total								
	Original Application	Side Dressing		1929	1930	1931	1932	1933	1935	1936	Average
None	15-54-30	None	15-54-30	1346	968	945	869	1331	752	1017	1032
50	15-54-30	0-0-25	15-54-55	1352	862	1052	1096	1348	774	931	1059
100	15-54-30	0-0-50	15-54-80	1466	934	1130	1098	1475	799	914	1117
150	15-54-30	0-0-75	15-54-105	1494	1035	1216	1135	1698	871	912	1194
200	15-54-30	0-0-100	15-54-130	1609	1128	1327	1181	1769	877	997	1269

Reference: Georgia Coastal Plain Experiment Station Bulletin 28, page 21, table 9, "Seventeenth Annual Report," Tifton, Georgia.

Tifton, Georgia is located on about the same latitude as the following Mississippi counties: Adams, Franklin, Lincoln, Lawrence, Jefferson Davis, Covington, Jones and Wayne.

THE RATE AND TIME OF APPLYING POTASH FERTILIZERS TO COTTON IN SOUTH CAROLINA

Conducted by South Carolina Agricultural Experiment Station in cooperation with farmers of South Carolina.

Conducted at: In the Piedmont and Coastal Plain sections of the state.

Period: 1931-1936.

Purpose: To determine the time and rate of applying potash fertilizers to cotton.

Soil: Coastal Plain soils: Marlboro sandy loam and Ruston sandy loam.
Piedmont Soils: Iredell and Alamance soils.

Procedure and Conditions: All plots in these tests received the equivalent of 600 pounds per acre of a 5-10-0 fertilizer in addition to the potash before the crop was planted and were side-dressed with 15 pounds of nitrogen. Potash was used at the rates of 0, 15, 30, 45, 60 and 75 pounds per acre, these rates making the total fertilizer application equivalent to 600 pounds per acre of 5-10-0, 5-10-2.5, 5-10-5, 5-10-7.5, 5-10-10, and 5-10-12.5, respectively.

The average yields represent results from around 40 to 85 separate plots. The 75 pound rate was not included in the 1931 and 1932 experiments.

Results: Average Yield in Pounds Seed Cotton Per Acre from Experiments on Rate and Time of Applying Potash Fertilizer to Cotton, 1931-1936

Pounds of Potash Applied	Time of Application	Yield of seed cotton in pounds per acre										Increase over preceding treatment	Inc. over no potash		Increase of seed cotton for each lb. of Potash
		1931	1932		1933		1934		1936		Av. for each		Lbs.	Per cent	
			Pied-mont	C. Plains	Pied-mont	C. Plains	Pied-mont	C. Plains	Pied-mont	C. Plains					
None	All before planting	.....	589	333	669	388	806	828	1045	665	665	.....	.....	.....	
	½ before planting	1212	754	613	833	739	996	1003	1173	915	922	257	257	38.6	
	½ at chopping	1217	741	593	813	702	992	957	1175	899	.....	.....	.....	.....	
	All at chopping	1245	....	745	792	865	965	892	1158	952	.....	.....	.....	.....	
30	All before planting	.....	.....	.....	.....	.....	.....	996	1286	1141	.....	.....	.....	.....	
	(24 checks)	.....	.....	.....	.....	.....	.....	992	1302	1064	.....	.....	.....	.....	
	All before planting	1311	883	900	987	968	1167	936	1295	1045	1065	143	400	60.2	
	½ before planting	1377	873	788	996	958	1138	886	1275	1010	.....	.....	.....	.....	
45	½ before chopping	1340	881	672	991	906	1126	1019	1376	1168	.....	.....	.....	.....	
	All at chopping	1399	1005	993	1081	1138	1329	1019	1376	1168	.....	.....	.....	.....	
	All before planting	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
	½ before planting	1425	1000	991	1100	1133	1313	1052	1366	1172	1149	84	484	72.8	
60	½ at chopping	1387	943	830	1110	998	1294	918	1364	1106	.....	.....	.....	.....	
	All at chopping	1492	1092	1132	1192	1114	1484	1075	1461	1255	.....	.....	.....	.....	
	All before planting	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
	½ before planting	1526	1056	1083	1167	1149	1514	1096	1448	1255	1245	96	580	87.2	
75	½ at chopping	1506	1113	928	.....	1094	1511	1015	1402	1224	.....	.....	.....	.....	
	All at chopping	.....	.....	.....	.....	1159	1563	1093	1515	1287	.....	.....	.....	.....	
	All before planting	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
	½ before planting	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
.....	½ at chopping	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
	All at chopping	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	

Reference: South Carolina Agricultural Experiment Station Fiftieth Annual Report, pages 30, 31 and 32, table 11, December 1937, Clemson College, South Carolina.

FERTILIZER FORMULA TEST WITH COTTON AT TIFTON, GEORGIA

Conducted by: Georgia Coastal Plain Experiment Station.

Conducted at: Tifton, Georgia.

Period: 1929-1936.

Purpose: To determine the best analysis for cotton fertilizer.

Soil: The cotton work at the Georgia experiment station has been largely on a typical Tifton sandy loam with work also being done on a light phase of Tifton sandy loam which very closely resembles Norfolk sandy loam. The results of this work, therefore, should be applicable to both Tifton and Norfolk soil types.

Procedure and Conditions:

Fertilizer:

Source of nitrogen: Nitrate of soda containing 15% nitrogen.

Source of phosphorus: Superphosphate containing 16% phosphoric acid.

Source of potash: Muriate containing 50% potassium.

Date of applying fertilizer in relation to the bed: Ten to 14 days before planting.

How fertilizer was applied in relation to the bed: Applied to furrow and bedded on. Fertilizer was about three inches below seed.

Average planting date: April 1.

Size of plots: 1/40 acre.

Width of rows: 3.3 feet.

Number of replications: 2.

Variety of cotton used: Petty's Toole.

Boll weevil control measures used: About 2 pounds calcium arsenate per acre mopped on.

The experiment has not been run continuously on the same land.

Fertilizer Formula Test With Cotton

N-P-K Per Acre	Equivalent to 600 lbs. per acre of	Yield in Pounds Seed Cotton Per Acre								
		1929	1930	1931	1932	1933	1934	1935	1936	Average
Phosphoric acid series										
15-0-30	2½-0-5	785	522	1408	761	1369	739	508	624	839
15-24-3	2½-4-5	845	592	1307	828	1602	852	624	821	934
15-54-30	2½-9-5	995	638	1186	890	1620	963	681	1003	997
15-72-30	2½-12-5	1060	652	1225	1017	1549	958	729	967	1020
Nitrogen series										
0-54-30	0-9-5	575	465	1179	738	1456	620	422	706	769
8½-54-30	1½-9-5	870	607	1268	1013	1712	696	579	707	932
12-54-30	2½-9-5	965	633	1361	967	1606	708	607	875	962
16¾-54-30	3½-9-5	830	653	1285	908	1465	721	597	864	915
21-54-30	3¾-9-5	970	661	1370	975	1764	683	589	973	998
25-54-30	5-9-5	1040	657	1480	936	1606	839	697	980	1029
Potash series										
15-54-0	2½-9-0	420	316	957	431	1065	817	203	721	616
15-54-12	2½-9-2	705	413	1166	684	1205	852	473	843	793
15-54-24	2½-9-4	770	502	1240	772	1660	698	651	938	904
15-54-30	2½-9-5	960	571	1165	919	1536	753	652	843	925
15-54-36	2½-9-6	975	622	1420	842	1768	738	708	815	986
15-54-48	2½-9-8	1070	734	1371	1099	1672	726	741	965	1047
15-54-60	2½-9-10	1035	778	1518	1002	1598	833	774	903	1055
0-0-0	None	325	267	848	248	1065	520	118	395	473

Reference: Georgia Coastal Plain Experiment Station Bulletin 28, page 18, table 5, Seventeenth Annual Report, 1935-1936, September 1936, Tifton, Georgia.

LOW ANALYSIS VERSUS HIGH ANALYSIS FERTILIZER FOR COTTON

According to the production of cotton per acre, which is the more economical, high-analysis or low-analysis fertilizers?

- a. Which produces more cotton per acre?
- b. Which costs more for a given amount of plant food per acre when
 - (1) home mixed?
 - (2) when bought ready-mixed?
- c. Which requires less labor for hauling and applying?
- d. When figured according to Form 1, which shows a higher cash income per acre.

THE EFFECT OF HIGH AND LOW ANALYSIS FERTILIZER ON THE YIELD OF COTTON IN ALABAMA

Conducted by: Alabama Agricultural Experiment Station.

Conducted at: Various sections of the State.

Period: 1930-1931.

Purpose: To compare the efficiency of a commonly used fertilizer mixture (Superphosphate, ammonium sulphate, sodium nitrate and muriate of potash) with a mixture (Ammono-Phos A and B and muriate of potash) which had a much higher analysis. These were compared with and without limestone.

Soil: Coastal Plain soils.

Procedure and Conditions:

Fertilizer: The fertilizer rates per acre were as follows:

64 pounds phosphoric acid.

29.6 pounds nitrogen.

37.5 pounds potash.

Limestone at the rate of 116 pounds per acre was mixed with the fertilizer and used on one-half of each area. This amount of limestone was necessary to neutralize the acidity developed by Ammono-Phos applications.

In most cases the initial fertilizer application was made by hand and mixed with the soil from 5 to 10 days before planting the cotton. For the side application the fertilizer was placed in a shallow furrow near the plants and was covered immediately. This application was made, in most cases, after the cotton was thinned and before the first cultivation.

Results:

Average Yield, Pounds Per Acre, of Seed Cotton on Coastal Plain Soils from Low and High Analysis Fertilizers in Alabama, 1930-1931

Plot No.	Pounds Fertilizer Per Acre		Pounds N-P-K Per Acre			Coastal Plain, 56 Tests, Av. Yield Seed Cotton Lbs.
	Before Planting	Side Dressing	Before Planting	Side Dressing	Total	
1	400 Superphosphate 36 Ammonium sulphate 75 Muriate of potash	137 sodium nitrate	7½-64-37½	21.9-0-0	29.4-64-37½	1.124*
2	85 Ammo-Phos A 125 Ammo-Phos B 75 Muriate of potash	None	29½-64-37½	None	29½-64-37½	1.016
3	85 Ammo-Phos A 75 Muriate of Potash	125 Ammo-Phos B	9½-39-37½	20-25-0	29½-64-37½	1.053
5	400 Superphosphate 36 Ammonium sulphate 75 Muriate of potash 116 Limestone	137 sodium nitrate	7½-64-37½ and lime	21.4-0-0	29.4-64-37½ and lime	1.105*
6	85 Ammo-Phos A 125 Ammo-Phos B 75 Muriate of potash 116 Limestone	None	29½-64-37½ and lime	None	29½-64-37½ and lime	1.054
7	85 Ammo-Phos A 75 Muriate of potash 116 Limestone	125 Ammo-Phos B	9½-39-37½ and lime	20-25-0	29½-64-37½ and lime	1.075

*Average of duplicate plots.

Reference: Alabama Agricultural Experiment Station Bulletin 238, pages 17, 19 and 20, table 6, "Experiments with Commercial Nitrogenous Fertilizers," August 1932, Auburn, Alabama.

HIGH ANALYSIS FERTILIZER TEST WITH COTTON AT TIFTON, GEORGIA

Conducted by: Georgia Coastal Plain Experiment Station.

Conducted at: Tifton Georgia.

Period: 1926-1931.

Purpose: To make a comparison of fertilizers of high concentration with a 9-3-5 fertilizer.

Soil: The cotton work at the Georgia experiment station has been largely on a typical Tifton sandy loam with work also being done on a light phase of Tifton sandy loam which very closely resembles Norfolk sandy loam. The results therefore, should be applicable to both Tifton and Norfolk soil types.

Procedure and Conditions:

Fertilizer: Fertilizers for this test were made from the following materials:

Superphosphate 16%	Nitrate of soda 15%
Triple superphosphate 44%	Urea 45.8% nitrogen
Nitrophoska 15-48-15	Muriate 50% potash
Manure salts 20% potash	

Date of applying fertilizer in relation to planting date: Ten to 14 days before planting.

How was fertilizer applied in relation to the bed: Applied to furrow, bedded on. Fertilizer about 3 inches below seed.

Average planting date: April 1.

Size of plots: 1/20 acre.

Number of replications: Two.

Boll weevil control measures used: Mopped once each year using about 2 pounds calcium arsenate per acre.

The experiment has been run continuously on the same land.

High Analysis Fertilizer Test With Cotton

Pounds N-P-K Per-Acre	Rate (Lbs.)	Formula	Yield in Pounds Seed Cotton Per Acre						
			1926	1927	1928	1929	1930	1931	Average
12½-45-25	500	2½-9-5	834	664	610	635	411	1267	735
12½-45-25	300	4½-15-8.3	597	550	510	747	511	1297	702
12½-45-25	250	5-18-10	745	607	620	812	545	1452	797
12½-45-25	187½	6¾-24-13.3	638	531	650	740	515	1349	737
12½-45-25	150	8¾-30-16.6	659	514	670	582	425	1304	692
25-90-50	1000	2½-9-5	1070	864	900	967	678	1624	1017
25-90-50	600	4½-15-8.3	841	806	980	810	807	1679	987
25-90-50	500	5-18-10	1021	861	960	857	739	1581	1003
25-90-50	375	6¾-24-13.3	1000	751	960	702	656	1585	942
25-90-50	300	8¾-30-16.6	948	775	905	580	549	1561	886

Reference: Georgia Coastal Plain Experiment Station Bulletin 19, page 16, table 4, "Twelfth Annual Report," June 1932, Tifton, Georgia.

Tifton, Georgia is located on about the same latitude as the following Mississippi counties: Adams, Franklin, Lincoln, Lawrence, Jefferson Davis, Covington, Jones and Wayne.

A COMPARISON OF ORDINARY-ANALYSIS AND CONCENTRATED FERTILIZERS AT FAYETTEVILLE, NORTH CAROLINA

Conducted by: United States Department of Agriculture in cooperation with the North Carolina Agricultural Experiment Station.

Conducted at: Fayetteville, North Carolina.

Period: 1931-1933.

Purpose: To compare sodium nitrate, ammonium sulphate, and urea as sources of nitrogen in concentrated fertilizers with ammonium phosphate and potassium sulphate.

Soil: Ruston sandy loam.

Procedure and Conditions:

Fertilizers: Fertilizers were prepared in double strength, analyzing 12% ammonium, 16% phosphoric acid and 16% potash and compared with a 6-8-8 fertilizer containing superphosphate, nitrogen, and potassium sulphate.

Analysis of ammonium phosphate: 11% P₂O₅.

Method of applying fertilizer in relation to the bed: Applied in the drill, stirred and covered so that when seeds are planted fertilizer will be about 3 inches below seed.

Date of applying fertilizer in relation to planting date: Seven to 10 days before planting.

Size of plots: 1/25 acre.

Width of rows: 3½ feet.

Number of replications: Two.

Variety of cotton used each year: Coker's Farm Relief.

Boll weevil control measures: None except that early shedded squares were picked up.

The experiment has been run continuously on the same land, each plot following itself each year of the experiment. No cover crops have been grown during the progress of this experiment. Prior to this experiment the average yield of corn per acre without fertilizer was 50 bushels.

The field was in corn and soybeans the year before the experiment was

begun. All except the slip-shucked corn was turned under for soil improvement. The growth of soybeans was about 3,000 pounds per acre.

Preceding the inauguration of the experiment the field had grown cotton in rotation with corn interplanted with soybeans. The vegetation produced by the soybeans was plowed under in the fall for green manure. By this practice the soil had been maintained at a high level of fertility, and large yields of cotton were secured. The year preceding the inauguration of the experiment, the field was in corn and soybeans and a mass of vegetation from the soybean vines was turned under late in the fall. Cotton was grown continuously in the experiment for three years, each plot receiving identical fertilizer treatments each year, and no vegetation except cotton stalks was grown or turned under during the three year period.

Results:

Yields of Cotton from Ordinary-Analysis Fertilizer and Concentrated Fertilizer at Fayetteville, N. C.

Each Plot, Except Checks, Received 48-64-64. Pounds N-P-K Per Acre

Fertilizer Analysis N-P-K	Rate per acre Lbs.	Source of Fertilizer Material	Yield in Pounds Seed Cotton Per Acre			
			1931	1932	1933	Average
6-8-8	800	Superphosphate, sodium nitrate and potassium sulphate	2100	1437	2150	1896
6-8-8	800	Superphosphate, sodium nitrate, cottonseed meal and potassium sulphate*	2025	1538	2125	1896
12-16-16	400	Ammonium phosphate, sodium nitrate, and potassium sulphate	1836	1324	1603	1588
6-8-8	800	Superphosphate, ammonium sulphate and potassium sulphate	1975	1387	1788	1717
6-8-8	800	Superphosphate, ammonium sulphate, cottonseed meal and potassium sulphate**	2075	1537	1862	1825
12-16-16	400	Ammonium phosphate, ammonium sulphate, and potassium sulphate	1675	1292	1557	1508
6-8-8	800	Superphosphate, urea and potassium sulphate	1975	1437	1762	1725
6-8-8	800	Superphosphate, urea, cottonseed meal and potassium sulphate***	2135	1335	2012	1827
12-16-16	400	Ammonium phosphate, urea and potassium sulphate	1812	1208	1200	1427
No Fert.			1025	762	870	886

*Nitrogen derived 65% sodium nitrate and 35% from cottonseed meal.

**Nitrogen derived 65% ammonium sulphate and 35% from cottonseed meal.

***Nitrogen derived 65% urea and 35% from cottonseed meal.

Reference: United States Department of Agriculture Technical Bulletin 452, page 26, table 12, "Experiment with Nitrogen Fertilizers on Cotton Soil," October 1934, Washington, D. C.

EFFECT OF LIMESTONE ON HIGH AND LOW ANALYSIS ACID FERTILIZERS ON COTTON YIELDS IN NORTH CAROLINA

Conducted by: North Carolina Agricultural Experiment Station.

Conducted at: Goldsboro, Fayetteville and Garysburg, North Carolina.

Period: 1934-1936.

Purpose: To compare high and low analysis acid fertilizers with and without limestone when used on cotton.

Soil: Norfolk sandy loam, Ruston sandy loam and Greenville sandy loam.

Procedure and Conditions: Other factors other than the ones mentioned in the test remained the same in all the experiments.

Results:

Effect of Limestone on High and Low Analysis Acid Fertilizers on Cotton Yields in North Carolina

No.	Fertilizer Analysis	Supplement Added to Fertilizer	Equivalent Acidity Per Ton Fertilizer	Norfolk sandy loam	Ruston sandy loam	Greenville sandy loam	
				Goldsboro N. C.	Fayetteville N. C.	Garysburg, N. C.	
				pH ^o 5.0-5.1	pH ^o 5.5-5.7	pH ^o 7.5	
				Average 1934-36	Average 1934-35	Average 1934-35	1936
				Pounds Per Acre	Pounds Per Acre	Pounds Per Acre	Pounds Per Acre
1	4-8-4*	None	364½/	1288	1536	1230	1080
2	4-8-4	Calcium limestone	0	1353	1510	1225	1206
3	4-8-4	Calcium limestone, magnesium limestone	0	1333	1500	1218	1120
4	4-8-4	Dolomitic limestone	0	1325	1575	1262	1323
5	4-8-4	Same as 4, except urea replaces cottonseed meal	0	1318	1615	1144	1120
6	8-16-8**	None	356	1267	1375	1356	1012
7	8-16-8**	Dolomitic limestone	0	1426	1496	1407	1404
8	8-16-8***	None	240	1266	1432	1586	1204
9	8-16-8****	Dolomitic limestone	0	1337	1583	1587	1436
x		No fertilizer		638	826	568	459

*4-8-4 fertilizer contains ammonium sulphate, cottonseed meal, superphosphate, and potas-

sium sulphate, except for supplements indicated.

**contains ammonium phosphate, urea (50% N.) and ammonium sulphate.

***same as plot No. 6 except proportions of nitrogen sources varied.

****contains ammoniated triple superphosphate, urea (50% N.), ammonium sulphate, potassium nitrate and potassium chloride.

1/ Lime necessary to add per ton of fertilizer to make neutral.

©pH given as of the beginning of the test.

The acid forming fertilizers reduced the pH of the soil in nearly all cases some and in some cases was appreciably reduced in the third year. Where lime was added to keep pH from being reduced yields were fairly comparable.

Reference: Soil Science, Volume 44, No. 1, July 1937, pages 19, 20 and 21, "Adapting High Analysis and Concentrated Fertilizers to Cotton Soils," by J. J. Skinner, United States Department of Agriculture, H. B. Mann and E. R. Collins, North Carolina Agricultural Experiment Station, E. T. Batten, Virginia Agricultural Experiment Station, and R. P. Bledsoe, Georgia Agricultural Experiment Station.

FACTORY-MIXED VERSUS HOME-MIXED FERTILIZER

Which is more economical, factory-mixed or home-mixed fertilizers?

a. Which produces more cotton per acre when equal amounts of plant nutrients per acre are used?

b. Which costs less per unit of plant nutrients?

c. How well does the mixing of fertilizer fit into the labor distribution of your farm?

FACTORY VERSUS HOME MIXED FERTILIZER, RAYMOND, MISSISSIPPI

Conducted by: Raymond Branch Experiment Station.

Conducted at: Raymond, Mississippi.

Period: 1929-1933.

Purpose: To determine whether home-mixed or factory-mixed is the best fertilizer for cotton.

Soil: Olivier silt loam.

Procedure and Conditions:

Date of applying fertilizer: 1929, May 1; 1930, April 17; 1931, May 2; 1933, May 10.

Date of planting: 1929, May 1; 1930, April 22; 1931, May 4; 1933, May 12.

Method of preparing seed bed: Land double disked, plowed broadcast, harrowed, laid off in rows with middlebreaker, fertilizer applied by hand in water furrow and bedded on with middlebreaker. Beds harrowed and planted.

Size of plots: 1/20 acre.

Width of rows: 3½ feet.

Number of replications: 5.

Variety of cotton used: 1929-31, Lone Star 65; 1933, Starfos*.

In 1929 the weather was very cool following planting, the temperature going as low as 40° F.

*Starfos is a cross between Lone Star 65 and Delfos 6102.

Results:

Factory Versus Home-Mixed Fertilizer at Raymond, Mississippi

Each plot received 32-64-32 pounds N-P-K per acre

800 lbs. 4-8-4 or 200 lbs. 15-30-15 per acre	Increase over no fertilizer in pounds seed cotton per acre				
	1929	1930	1931	1933	4 year average
Jackson 4-8-4	281	343	307	148	270
Home mixed 4-8-4 (superphosphate)	392	283	343	509	382
Nitro-phoska 15-30-15	246	295	187	286	258
Meridian 4-8-4	304	375	313	305	324
Home mixed 4-8-4 (Rhums)	256	370	237	391	313
Plant food Canton 4-8-4	284	473	207	299	316
No fertilizer (Av. 3 plots)	1192	1344	1395	1629	1390

Discontinued after 1933.

Reference: Record cards of the station.

FACTORY-MIXED VERSUS HOME-MIXED FERTILIZER FOR COTTON, POPLARVILLE, MISSISSIPPI

Conducted by: South Mississippi Branch Experiment Station.

Conducted at: Poplarville, Mississippi.

Period: 1927-1931.

Purpose: The purpose of this test was to determine whether factory-mixed or home-mixed fertilizer is the best for cotton.

Soil: Ruston fine sandy loam.

Procedure and Conditions:

Time of applying fertilizer: 1927, March 29; 1928, March 28; 1929, April 13; 1930, 10 days prior to planting; 1931, 10 days prior to planting.

Date of planting: 1927, April 4; 1928, May 4; 1929, April 23; 1930, about April 1; 1931, about April 1.

Size of plots: 1/20 acre.

Width of rows: 3½ feet.

Spacing of plants in drill: Hoe width.

Variety of cotton: 1927, Lone Star 65; 1928, Cleveland 54; 1929-31, D. & P. L. 5242A-310-46.

During what years have cover crops been grown on these plots: 1930 and 1931.

Kind of cover crops: Oats.

Results

Factory Mixed Versus Home-Mixed Fertilizer for Cotton

N-P-K Applied Per Acre		Analysis	Lbs. Seed Cotton Per Acre Increase Over No Fertilizer					
Factory Mixed	Home Mixed		1927	1928	1929	1930	1931	Average
24-48-24	24-48-24	4-8-4	516	183	796	317	847	532
		4-8-4	449	116	888	393	874	544
24-48-24		4-8-4*	377	86	878	401	764	501
No fertilizer			648	716	967	560	393	656

All applications at the rate of 600 pounds per acre.

*5-8-4 in 1929 and 1928 (30-48-24 pounds N-P-K per acre).

Reference: Annual Reports of the Station.

NITROGEN SOURCES FOR COTTON

What is the most economical source of nitrogen on your soil type, considering cost per pound of nitrogen and yield per acre? How many of the sources are available in your community?

For a definition of organic and inorganic nitrogen sources see explanation under Organic and Inorganic Nitrogen Sources Test for Cotton.

Nitrogen Sources Test with Cotton on Different Soil Types in Alabama

Conducted by: Alabama Agricultural Experiment Station.

Conducted at: Auburn, Alabama.

Period: 1927-1931.

Purpose: To study the relative value of the more common sources of nitrogen when used for short periods for cotton on the various Alabama soil regions.

Soil: Oktibbeha Soil Group—The experiments conducted on Black Belt soils were placed in the Oktibbeha soil group. Included in this group will be found all of the experiments that were located on either the Oktibbeha, Lufkin, or the Eutaw series. The experiments on the Oktibbeha group were conducted on soils that may be termed the non-lime or acid soils of this region. These soils are locally known as "post oak" or as "flatwoods" soils.

Greenville Soil Group—All of the experiments on red soils with red subsoil and on gray soils with red subsoil of the Coastal region have been grouped into the Greenville soil group. Included in this group will be found

all of the experiments conducted on Greenville, Amite, Cahaba, and Orangeburg soil series.

Norfolk Soil Group—All of the experiments conducted on Norfolk and on Ruston soils have been placed in the Norfolk soil group. This group includes all of the upland soils of the Coastal Plain Region which have a gray soil with yellow subsoil or gray soil with reddish-yellow subsoil.

Procedure and conditions: The different sources of nitrogen used for the full five-year period were sodium nitrate, ammonium sulphate, mixture of Ammo-Phos A and sodium nitrate, Leunasalpeter, urea, and cottonseed meal. Calcium nitrate was used in the experiments conducted in 1927 and 1928, and Calnitro and Calurea were included in 1929, 1930 and 1931. Each plot received 64 pounds of phosphoric acid and 25 pounds of potash per acre.

Each nitrogen-treated plot received 30 pounds of nitrogen per acre. Due to the fact that a fertilizer carrying the above quantities of nitrogen and phosphoric acid could not be made from Ammo-Phos A alone, it was necessary to supplement the Ammo-Phos A with another source of nitrogen. Consequently, all of the phosphoric acid and one-half of the nitrogen for this plot were from Ammo-Phos A and the remaining one-half of the nitrogen was from sodium nitrate. The cottonseed meal used in these experiments contained seven per cent of ammonia. It was used on the basis of 5.76 per cent nitrogen, 2.5 per cent phosphoric acid, and 1.5 per cent potash.

All the phosphoric acid except that in Ammo-Phos A and in cottonseed meal was from superphosphate.

All the potash except the small quantity in cottonseed meal was from muriate of potash.

Average Yield of Seed Cotton on Various Soil Regions of Alabama from Different Sources of Nitrogen

All plots received 64 pounds phosphoric acid and 25 pounds potash per acre. All except check plots received 30 pounds of nitrogen.

Plot No.	Source of Nitrogen*	Oktibbeha Soil 16 Expts.	Greenville Soil 34 Expts.	Norfolk Soil 57 Expts.
1	No nitrogen	645	583	634
3	Sodium nitrate	854	948	949
4	Ammonium sulphate	791	936	891
6	No nitrogen	629	569	623
7	Ammo-Phos A**	858	915	838
8	Leunasalpter	777	907	890
9	Urea	808	905	894
10	Cottonseed meal	654	809	834
11	No nitrogen	626	570	629
	Average no nitrogen plots	633	574	629

*All plots received 64 pounds of phosphoric acid and 25 pounds of potash and all nitrogen plots received 30 pounds of nitrogen per acre.

**One-half of the nitrogen from Ammo-Phos A and one-half from sodium nitrate.

Reference: Alabama Agricultural Experiment Station Bulletin 238, pages 6 and 8, table 1, "Experiments with Commercial Nitrogenous Fertilizers," August 1932, Auburn, Alabama.

Winter Legume and Cotton Test at Raymond, Mississippi

Conducted by: Raymond Branch Experiment Station.

Conducted at: Raymond, Mississippi.

Period: 1929-1934.

Purpose: To determine the effect of winter legumes on the yield of cotton.

Soil: Olivier silt loam.

Land History: In the fall of 1925, a good cotton year, this piece of land produced an average of 300 pounds seed cotton per acre. Oats, vetch and burr clover were planted in 1925 and turned under. In the spring of 1926 velvet beans were planted over an application of 400 pounds per acre of equal parts, cottonseed meal and superphosphate. In the fall of 1926 the velvet beans were turned under and land was planted to oats, vetch and volunteer burr clover. In the spring of 1927 the cover crop was turned under and soy beans were planted in rows and cut for hay. In the fall of 1927 the land was planted to oats and vetch and cut for hay in the spring of 1928. This was followed by soybeans and they were turned under. The above test was begun in the fall of 1928.

Procedure and Conditions:

Date of applying fertilizer: 1929, April 15; 1930, April 30; 1931, April 27; 1933, May 9; 1934, April 20.

Date of planting: 1929, April 18; 1930, May 1; 1931, April 28; 1933, May 9; 1934, April 20.

Size of plots: 1/20 acre. Between plots was a skip row.

Number of replications: Four.

Variety of cotton used: 1929-31, Lone Star 168; 1932-34, Lone Star 561.

Results: Winter Legume and Cotton Test at Raymond, Mississippi

Cover Crop	Fertilizer Per Acre		Actual Yield Per Acre in Pounds						
	Pounds N-P-K	Equivalent to 600 lbs.	Seed Cotton						
			1929	1930	1931	1932	1933	1934	Av.
None	36-48-24	6-8-4	1420	1368	1245	946	1418	1227	1271
Hairy vetch	0-48-24	0-8-4	1133	1439	1037	839	1368	1143	1160
Monantha vetch	0-48-24	0-8-4	1265	1258	1112	777	984	758	1026
None	0-48-24	0-8-4	1061	1207	738	576	919	531	846
None	36-48-24	6-8-4	1613	1665	1425	1046	1569	1341	1443
Burr clover	0-48-24	0-8-4	965	1165	1110	816	955	570	930
Crimson clover	0-48-24	0-8-4	942	1069	744	785	951	684	862
Austrian peas	0-48-24	0-8-4	1021	1027	863	854	930	860	926
None	36-48-24	6-8-4	1267	1368	1279	944	1279	1123	1208

Reference: Records from Raymond Branch Experiment Station, Raymond, Mississippi.

Winter Legume and Fertilizer Test with Cotton at Natchez, Mississippi

Conducted by: Natchez Branch Experiment Station.

Conducted at: Natchez, Mississippi.

Period: 1934-1937.

Purpose: To determine the effect of winter legumes on the yield of cotton.

Procedure and Conditions: Fertilizer was applied to cotton following winter legumes.

Results: Winter Legume and Fertilizer Test with Cotton.

Legume and Fertilizer	Yield in Pound of Lint Cotton Per Acre				
	1934	1935	1936	1937	Average
Hairy vetch (400 pounds 0-8-4)	564	440	852	1137	748
Austrian peas (400 pounds 0-8-4)	572	528	869	1071	760
No cover crop (400 pounds 6-8-4)	604	506	815	1054	744
Crimson clover (400 pounds 0-8-4)	527	471	806	1045	712

Reference: Mississippi Agricultural Experiment Station Information Sheet 141, "Cotton Fertilization," January 1938, State College, Mississippi.

THE EFFECT OF WINTER COVER CROPS ON THE YIELD OF COTTON

Conducted by: North Louisiana Experiment Station.

Conducted at: Calhoun, Louisiana.

Period: Six years—1931-1936.

Purpose: To test the effect of winter cover crops on the yield of cotton.

Procedure and Conditions: All of the plots received an application of 0-9-5 at the rate of 500 pounds per acre, either at the time the cover crops were planted in the fall, or at the time they were turned under in the spring, previous to planting cotton.

The check plot was bare in the winter and received an application of 500 pounds of 0-9-5 fertilizer in the spring.

Some of the plots growing legumes were limed with a waste product of the Brown Paper Mill at West Monroe, Louisiana.

For the past several years, the work of the North Louisiana Experiment Station has been materially affected by continued dry weather during the growing season. In 1936 the rains came about once a month, during April, May, June and July. During the 96 days after July 3, 0.88 inch of rain fell, the temperature averaging approximately 100 degrees during that time. Most of the projects were affected by the hot dry weather, although the crops that were planted early made average yields in most cases.

Dry, hot winds during the latter part of July affected cotton production considerably, causing the cotton to throw off all forms and small bolls. All of the cotton was harvested at one picking, there being nothing for which to go back a second time.

Results:

Six Year Average Results in Cotton Production Following Winter Cover Crops

Winter Cover Crop Grown	Cover crop yields, tons per acre	Cotton Fertilization	Seed cotton per acre, 1936	Increase over Check	Six years' average yield	Six years' Av. increase over check
Bare—No cover crop		*s 240 lbs. Chilean nitrate s. s 300 lbs. 16% superphosphate s 60 lbs. muriate potash	742	218	1049	257
Oregon common vetch	3.61 [⊙]	s 300 lbs. 16% superphosphate s 60 lbs. muriate potash	687	163		
Crimson clover	[⊙] None	s 300 lbs. 16% superphosphate s 60 lbs. muriate potash	614	90		
Bare—Check		s 300 lbs. 16% superphosphate s 60 lbs. muriate potash	524	.....	792	....
Hairy vetch	5.68	s 300 lbs. 16% superphosphate s 60 lbs. muriate potash	615	91	1036	244
Hairy vetch	6.69	f 300 lbs. 16% superphosphate f 60 lbs. muriate potash	569	45	957	165
Hairy vetch—limed (1½ tons lime per A.)	8.39	f 300 lbs. 16% superphosphate f 60 lbs. muriate potash	674	150	1022	230
Hairy vetch—limed (1½ tons lime per A.)	6.89	f 300 lbs. 16% superphosphate s 60 lbs. muriate potash	653	129	1053	261
Austrian winter peas	6.36	s 300 lbs. 16% superphosphate s 60 lbs. muriate potash	738	214	1040	248
Austrian winter peas	6.92	f 300 lbs. 16% superphosphate f 60 lbs. muriate potash	744	220	967	175
Austrian winter peas (Limed)	7.78	f 300 lbs. 16% superphosphate f 60 lbs. muriate potash	718	194	1054	262
Hungarian vetch	4.46	f 300 lbs. 16% superphosphate s 60 lbs. muriate potash	704	180	908	116

* "s" indicates application of material in spring, previous to planting cotton.

"f" indicates fall application, previous to planting cover crops.

⊙ results for one year only.

Reference: Biennial Report of the North Louisiana Experiment Station 1935-1936, pages 4, 5, and 6, table 5, Calhoun, Louisiana.

COTTON FOLLOWING WINTER COVER CROPS IN LOUISIANA

Conducted by: Northeast Louisiana Experiment Station.

Conducted at: St. Joseph, Louisiana.

Period: 2 to 7 years.

Purpose: To determine the effect of winter legumes on the yield of cotton.

Soil: Very light sandy loam—poorest on station farm.

Land History: The land used for this experiment has been in cultivation approximately 100 years and is badly eroded.

Procedure and Conditions:

Fertilizers: A series of plots in this test received annually 150 pounds of nitrate of soda applied as a side-dressing after chopping the cotton. These plots had never grown any cover crops.

Planting dates:

Legumes: Middle of October on the sides of the old cotton rows.

Cotton: Three or four weeks after legume was turned. Legumes were turned under about April 1.

Rate of seeding: Austrian winter peas, Tangier peas, and Hungarian, Common and Monantha vetches are seeded at the rate of 32 pounds per acre. The other vetches are seeded at the rate of 24 pounds per acre.

Results:

Cotton Following Winter Cover Crops

Cover Crop	Yield Cover Crop	Yield Cotton	Increase*	Years
Check		1027		7
150 pounds nitrate of soda		1450	423	7
Austrian winter peas	18,837	1878	851	7
Tangier peas	14,824	1689	787	3
Hairy vetch	22,497	2029	1002	7
Hungarian vetch	25,767	2100	1076	6
Common vetch	22,821	1956	925	5
Monantha vetch	31,157	2146	1122	6
Smooth vetch	21,297	1946	919	7
Purple vetch	13,136	1734	731	4
Wooly pod vetch	19,638	1916	943	2
Southern bur clover	16,677	1938	914	6
Mellilotus Indica	9,441	1402	434	5

*Increase is over average of checks in years in which crops were used.

Reference: Biennial Report (1935-1936) of the Northeast Louisiana Experiment Station, pages 7, and 8, table 10, St. Joseph, Louisiana.

COTTON FOLLOWING CORN AND SOYBEANS IN LOUISIANA

Conducted by: Northeast Louisiana Experiment Station.

Conducted at: St. Joseph, Louisiana.

Period: 1936.

Purpose: To determine the effect of soybeans as a soil builder for cotton.

Procedure and Conditions: It will be of interest to compare the cotton yields obtained following Biloxi soybeans grown in corn with yields of cotton following legumes. While this test has been conducted only one year the results seem to indicate that soybeans, when handled in the proper manner, are as efficient for soil building as the winter legumes.

Results:

Cotton Following Corn and Soybeans

Treatment	Yield Seed Cotton Pounds Per Acre	Increase Over Check
Corn alone — check	1226	.....
Corn and beans, cut for hay; stubble turned in spring	1810	584
Corn and beans, cut for hay; stubble turned in fall	1778	552
Corn and beans, whole plants turned in fall	2256	1030
Corn and beans, whole plants turned in spring	2157	931

Reference: Biennial Report (1935-1936) of the Northeast Louisiana Experiment Station, page 9, table 12, St. Joseph, Louisiana.

THE EFFECT OF VETCH TURNED AT VARIOUS DATES ON YIELD OF COTTON IN LOUISIANA

Conducted by: Northeast Louisiana Experiment Station.

Conducted at: St. Joseph, Louisiana.

Period: Two years.

Purpose: To determine the effect of vetch on the yield of cotton when turned at various dates.

Procedure and Conditions: The vetch was planted at the usual time and in the usual way and turned under on the dates indicated. All the cotton was planted at the same time, about May 1.

Results: Cotton Following Vetch Turned at Various Dates

Dates Turned	Yield, Vetch Pounds Per Acre	Yield, Cotton Pounds Per Acre	Increase
Check	.....	1298	.....
150 pounds nitrate of soda	.....	1588	290
March 15	4,975	1949	651
April 1	16,988	1962	664
April 15	19,670	2256	958

Reference: Biennial Report (1935-1936) of the Northeast Louisiana Experiment Station, page 8, table 11, St. Joseph, Louisiana.

COTTON NITROGEN SOURCES TEST, RAYMOND, MISSISSIPPI

Conducted by: Raymond Branch Experiment Station.

Conducted at: Raymond, Mississippi.

Period: 1925-1934.

Purpose: To determine the best source of nitrogen for cotton fertilizer.

Soil: Olivier silt loam.

Procedure and Conditions:

Fertilizer used:

1925—A general application of 300 pounds superphosphate and 150 pounds sulphate of potash per acre was made to each plot including checks (48 pounds P and 75 pounds K).

1927—All plots received 300 pounds 16% superphosphate and 40 pounds 48% muriate of potash per acre (48 pounds P and 20 pounds K).

1928—All plots received 600 pounds 0-8-4 fertilizer per acre (48 pounds P and 24 pounds K).

1929—All plots including checks were fertilized with 300 pounds superphosphate and 50 pounds muriate of potash per acre (48 pounds P and 25 pounds K).

Source of phosphorus: 16% and 20% superphosphate.

Source of potash: Muriate of potash.

Method of applying fertilizer: In water furrow and bedded on.

Dates of applying fertilizer: 1926, April 12; 1927, April 17; 1928, April 20; 1929, April 12; 1930, April 16; 1931, April 13; 1933, April 28; 1934, April 13.

Date of planting: 1925, May 14; 1926, April 17; 1927, April 20; 1928, April 21 (stand injured to average extent by frost on April 28); 1929, April 18; 1930, April 23; 1931, April 17; 1933, May 3; 1934, April 20.

Spacing of plants in the drill: 3 stalks per foot.

Size of plots: 1/20 acre.

Width of rows: 3½ feet.

Number of replications: Three.

Variety of cotton used: 1925-31. Lone Star 65; 1933-34, Starfos (Lone Star 65 crossed with Delfos 6102).

Results:

Nitrogen Sources with Cotton, Raymond, Mississippi

Pounds material applied per acre	Increase over no nitrogen in pounds seed cotton per acre									
	1925	1926	1927	1928	1929	1930	1931	1933	1934	Average
150 nitrate of soda	319	384	143	250	196	114	352	167	423	261
112.5 ammonia sulphate	271	268	168	253	141	190	347	357	315	257
86.5 Leunasalpeter	.....	390	168	170	182	335	364	.....	.....	.....
105 Calcium cyanamid	345	42	186	177	102	421	347	271	379	252
150 Calcium nitrate	322	248	175	398	253	223	404	.....	.....	279*
48.9 urea	365	231	160	358	294	304	438	309	103	285
Actual yield—no nitrogen	1482	1633	1459	871	1188	1687	968	1768	998	1339

*8 years only.

Test not run in 1932 due to lack of funds with which to buy fertilizer.

Reference: Record cards from Raymond Branch Experiment Station, Raymond, Mississippi.

NITROGEN SOURCES TEST FOR COTTON, NATCHEZ, MISSISSIPPI

Conducted by: Natchez Branch Experiment Station.

Conducted at: Natchez, Mississippi.

Period: 1929-1931.

Purpose: To determine the best source of nitrogen for cotton fertilizers.

Soil: Memphis silt loam.

Procedure and Conditions:

Fertilizer: All plots, including checks, received 72 pounds phosphoric acid and 36 pounds potash per acre. All plots except checks received 36 pounds nitrogen per acre or a total equivalent to 600 pounds 6-12-6 per acre.

Time and method of applying fertilizer: Five to ten days before planting, spread by hand in drill and covered. Cotton planted over fertilizer.

Date of planting: About April 15.

Size of plots: .06 acre.

Width of rows: 40 inches.

Number of replications: 4.

Spacing of plants in drill: Approximately 4 plants per foot.

Variety of cotton used: D. & P. L. No. 4.

Boll weevil control measures used: 1929, 3 applications, 6 pounds each; 1930, 2 application, 7 pounds each; 1931, 3 applications, 7 pounds each.

Before the experiment was begun the average yield of corn per acre without fertilizer was 20 bushels. Yield of seed cotton without fertilizer was 800 pounds.

Results:**Nitrogen Sources Test with Cotton**

Source	Lbs. Per Acre	Yield in Pounds Seed Cotton Per Acre				
		1929	1930	1931	Average	Av. Increase Over No nitrogen
No fertilizer		481	433	731	548	
No nitrogen		567	556	671	598	
Nitrate of soda	240	1313	896	1261	1157	559
Calcium nitrate	240	1239	938	1559	1245	647
Calurea	106	1139	905	1198	1081	482
Calcium cyanamid	171	1060	777	1258	1032	434
Leunasalpeter	138	1023	767	780	857	258
Cal-Nitro	176	1057	892	1192	1047	449
Ammonium sulphate	176		862			

Reference: Annual Reports of Natchez Branch Experiment Station, Natchez, Mississippi.

NITROGEN SOURCES TEST AT HOLLY SPRINGS, MISSISSIPPI

Conducted by: Holly Springs Branch Experiment Station.

Conducted at: Holly Springs, Mississippi.

Period: 1925-1934.

Purpose: To determine the best source of nitrogen for cotton fertilizers.

Soil: Unimproved sandy loam valley land, Lintonia silt loam, until 1929. 1929-1931, shallow phase Memphis silt loam underlain with Wilcox sand. Thin brown table land that has been cropped to cotton for more than one-half century with practically no soil improvement methods having been used.

Procedure and Conditions:**Fertilizer:**

1925—All plots including the checks had 200 pounds superphosphate and 50 pounds sulphate of potash per acre. Each nitrogen carrier was applied at such rate as to supply 22.5 pounds available nitrogen per acre.

1926-30—Four hundred pounds superphosphate and 67½ pounds sulphate of potash, 30 pounds available nitrogen.

1929-34—Thirty-six pounds available nitrogen.

Date of planting: 1925, April 18; 1926, April 27; 1927, May 18; 1928, planted over May 14; 1933, May 22.

Size of plots: 1/20 acre.

Width of rows: 3½ feet.

Number of replications: 3.

Variety of cotton used: 1925-27, Miss. Station Trice; 1928, Lone Star 79; 1933, Stoneville No. 3.

Results:**Nitrogen Sources Test with Cotton**

Source of Nitrogen	Increase over no nitrogen in pounds seed cotton per acre									
	1925	1926	1927	1928	1929	1930	1931	1933	1934*	Average
Ammonium sulphate	202	441	401	479	414	370	667	417	220	401 ¹
Calcium cyanamid	151	175	405	242	340	345	527	600	222	334 ¹
Nitrate of soda	247	538	393	482	462	437	647	658		483 ²
Calcium nitrate	332	425	503	453	417	450	358			420 ³
Leunasalpeter		510	451	423	432	340	794			492 ⁴
Urea	219	485	634	442						445 ⁵
Calnitro					436	381	647			488 ⁶
No nitrogen	1742	909	466	1008	388	360	190	383		681 ²

*Increase over no nitrogen in 1934. Yield with no fertilizer 1934, 472 pounds.

1932 experiment omitted because of lack of funds with which to buy fertilizer.

¹Nine years, 1925-1934.

³Seven years, 1925-1931.

⁵Four years, 1925-1928.

²Eight years, 1925-1933.

⁴Six years, 1926-1931.

⁶Three years, 1929-1931.

Reference: Annual reports Holly Springs Branch Experiment Station, Holly Springs, Mississippi.

NITROGEN SOURCES TEST WITH COTTON AT WEST POINT, MISSISSIPPI

Conducted by: Mississippi Agricultural Experiment Station.

Conducted at: West Point, Mississippi.

Period: 1926-1932.

Purpose: To determine the best source of nitrogen for cotton fertilizers.

Soil: Houston clay loam.

Procedure and Conditions:

Fertilizer used: Nitrate of soda, superphosphate, and muriate of potash.

Time and method of applying fertilizer: In water furrow by hand and and bedded on.

Size of plots: 1/20 acre.

Width of rows: 3 1/2 feet.

Number of replications: 3.

Results:**Nitrogen Sources Test with Cotton**

24-48-24 Lbs. N-P-K or 600 Lbs. 4-8-4 per acre Using as Nitrogen Sources	Increase in pounds seed cotton per acre over							
	600 pounds 0-8-4 per acre							
	1926	1927	1928	1929	1930	1931	1932	Average
Nitrate of soda	58	291	58	236	39	137	253	153.2
Ammonium sulphate	—10	262	181	234	6	72	247	141.7
Calcium cyanamid	27	254	123	255	29	12	199	128.4
Urea	11	223	94	176	57	108	154	117.6
Calcium nitrate	9	184	5	266	68	146		113.1*
Leunasalpeter	33	299	116	180	39			133.3**
Yield per acre from 600 lbs. 0-8-4 (0-48-24 lbs. of N-P-K)	728	628	365	936	644	435	405	591.6

*6 year average.

**5 year average.

Reference: Mississippi Agricultural Experiment Station Bulletin 289, page 24, table 31, "Commercial Fertilizers for Cotton, 1925-30," State College, Mississippi.

NITROGEN SOURCES WITH COTTON AT POPLARVILLE, MISSISSIPPI

Conducted by: South Mississippi Branch Experiment Station.

Conducted at: Poplarville, Mississippi.

Period: 1926-1931.

Purpose: To determine the best source of nitrogen fertilizer for cotton.

Soil: Ruston fine sandy loam.

Land History: Before the beginning of this test in 1926, this land had been used as a pasture. The land has been in cultivation about 75 years. The same land was used continuously for 6 years of the test, each nitrogen source following itself year after year on the same plots.

Procedure and Conditions:

Date of applying fertilizers: 1928, March 29; 1929, April 19; 1930, April 8.

Date of planting: 1928, May 4; 1929, April 20; 1930, April 18.

Spacing of plants in drill: Chopped to hoe width.

Size of plots: 1/20 acre.

Width of row: 3½ feet.

Number of replications: 3.

Variety of cotton used: 1928, Cleveland 54; 1929-30, D. & P. L. 5242A-310-46.

Poison applications: 1928, 3 applications of calcium arsenate; 1929 report indicates that some poison was applied, but the number of applications is not given.

Results:**Nitrogen Sources Test with Cotton**

600 Lbs. 4-8-4 per Acre (24-48-24 Lbs. N-P-K from)	Increase Over 600 Pounds 0-8-4 in Pounds Seed Cotton Per Acre						Average
	1926	1927	1928	1929	1930	1931	
Fish scrap	40	165	100	453	77	272	171
Tankage	5	128	69	454	92	260	168
½ fish scrap and ½ nitrate of soda	33	223	63	425	70	327	190
½ tankage and ½ nitrate of soda	85	176	138	475	101	423	233
Calcium nitrate		212	145	495	41	411	261
Dried blood				627	101	408	379
Yield per acre—600 Lbs. 0-8-4	993	902	677	1256	788	646	877

Reference: Mississippi Agricultural Experiment Station Bulletin 289, page 25, table 31, "Commercial Fertilizers for Cotton, 1925-1930," January 1931, State College, Mississippi.

NITROGEN SOURCES TEST FOR COTTON AT POPLARVILLE, MISSISSIPPI

Conducted by: South Mississippi Branch Experiment Station.

Conducted at: Poplarville, Mississippi.

Period: 1925-1931.

Purpose: To determine the best source of nitrogen fertilizer for cotton.

Soil: Ruston fine sandy loam.

Procedure and Conditions:

Dates of applying fertilizer: 1925, March 21; 1927, March 27; 1928, March 27; 1929, April 6; 1930, March 24.

Date of planting: 1925, March 21; 1927, May 4; 1928, May 4; 1929, April 20; 1930, April 17.

Spacing of plants in drill: Chopped to hoe width.

Size of plots: 1/20 acre.

Width of rows: 3½ feet.

Variety of cotton used: 1925, Miss. Station Trice; 1927, Cleveland 54; 1929, D. & P. L. 5242A-310-46.

Oats have been grown on this land each year of the test.

Results:

Nitrogen Sources Test for Cotton at Poplarville, Mississippi

600 Lbs. 6-8-4 Per Acre 36-48-24 Lbs. N-P-K from	Increase Over 600 Lbs. 0-8-4 in Pounds Seed Cotton Per Acre							
	1925	1926	1927	1928	1929	1930	1931	Average
Nitrate of soda	379	41	262	-21	597	284	513	286
Ammonium sulphate	350	94	209	65	411	19	421	224
Calcium cyanamid	141	3	328	65	344	89	508	211
Calcium nitrate	334	33	301	30	368	44	345	208
Urea	309	-22	326	135	256	-11	326	188
Leunasalpeter			350	64	312	-118	403	202*
Cal urea				164	294	22	355	209**
600 lbs. 0-8-4 (Actual yield)	1393	1146	624	500	713	753	458	79%

*Five-year average.

**Four-year average.

Reference: Annual reports of the station.

EFFECT OF FERTILIZERS CONTAINING NITROGEN FROM DIFFERENT SOURCES AND VARYING PERCENTAGES OF MINERAL, SYNTHETIC AND ORGANIC NITROGEN ON THE YIELD OF COTTON

Conducted by: United States Department of Agriculture in cooperation with North Carolina Agricultural Experiment Station.

Conducted at: Fayetteville, North Carolina.

Period: 1931-1933.

Purpose: To study the best ratio of inorganic and synthetic to organic nitrogen in fertilizer mixtures with phosphoric acid and potash.

Soil: Ruston fine sandy loam.

Land History: Preceding the inauguration of the experiment the field had grown cotton in rotation with corn interplanted with soybeans. The vegetation produced by the soybeans was plowed under in the fall for green manure. By this practice the soil had been maintained at high level of fertility, and large yields of cotton were secured. The year preceding the inauguration of the experiment, the field was in corn and soybeans and a mass of vegetation from the soybean vines was turned under late in the fall.

Procedure and Conditions: Fertilizer was applied at the rate of 800 pounds 6-8-8 or 0-8-8 per acre before planting.

Source of nitrogen: As noted.

Source of phosphorus: Superphosphate.

Source of potash: Potassium chloride.

Date of applying fertilizer: Seven to 10 days before planting.

Method of applying fertilizer: Applied in drill, stirred and covered so that when the seed were planted the fertilizer would be about 3 inches below the seed.

Average planting date: April 20.

Size of plot: 1/25 acre.

Width of row: 3½ feet.

Number of replications: Two.

Variety of cottonseed: Coker's Farm Relief.

Cotton was grown continuously in the experiment for three years, each plot receiving identical fertilizer treatments each year and no vegetation except cotton stalks was grown or turned under during the three year period.

Yields of Cotton from Fertilizer Containing Nitrogen from Different Sources and Varying Percentages of Mineral, Synthetic and Organic Nitrogen

Source of Nitrogen in 6-8-8 Fertilizer	Yield Lbs. Seed Cotton				Av. % open at first picking
	1931	1932	1933	Av. Yield	
No nitrogen	2370	1325	1425	1707	76.3
25% from sodium nitrate, 75% from cottonseed meal	2100	1350	2001	1817	74.0
50% from sodium nitrate, 50% from cottonseed meal	2100	1387	2050	1846	67.0
65% from sodium nitrate, 35% from cottonseed meal	2025	1538	2125	1896	65.6
80% from sodium nitrate, 20% from cottonseed meal	2225	1540	2219	1995	68.3
90% from sodium nitrate, 10% from cottonseed meal	2090	1537	2100	1909	64.3
100% from sodium nitrate, 0% from cottonseed meal	2100	1437	2150	1896	70.0
Average from sodium nitrate series	2107	1465	2108		
No nitrogen	2325	1362	1400	1696	78.6
25% from amm. sulphate, 75% from cottonseed meal	2100	1412	1802	1771	73.3
50% from amm. sulphate, 50% from cottonseed meal	2100	1487	1891	1826	74.6
65% from amm. sulphate, 35% from cottonseed meal	2075	1537	1862	1825	70.3
80% from amm. sulphate, 20% from cottonseed meal	2175	1562	1962	1900	68.3
90% from amm. sulphate, 10% from cottonseed meal	2110	1537	1825	1824	68.6
100% from amm. sulphate, 0% from cottonseed meal	1975	1387	1788	1717	71.3
Average of ammonium sulphate series	2089	1487	1855		
No nitrogen	2240	1325	1438	1668	75.3
25% from urea, 75% from cottonseed meal	2000	1437	1895	1777	78.6
50% from urea, 50% from cottonseed meal	1925	1524	1987	1812	73.0
65% from urea, 35% from cottonseed meal	2135	1335	2012	1827	72.3
80% from urea, 20% from cottonseed meal	2060	1362	1875	1766	70.3
90% from urea, 10% from cottonseed meal	2025	1500	1880	1802	72.0
100% from urea, 0% from cottonseed meal	1975	1437	1762	1725	73.3
Average from urea series	2019	1403	1902		

Reference: United States Department of Agriculture Technical Bulletin 452, page 18, 19 and 21, table 9, "Experiments with Nitrogen Fertilizers on Cotton Soils," October 1934, Washington, D. C.

A COMPARISON OF DIFFERENT SOURCES OF NITROGEN FOR COTTON ON LIMED AND UNLIMED SOIL IN ALABAMA

Conducted by: Alabama Agricultural Experiment Station.

Conducted at: Auburn, Alabama.

Period: 1928-1931.

Purpose: To study the influence of various nitrogenous fertilizers on cotton yields on unlimed and limed land during a period of years.

Soil: Norfolk sandy loam.

Procedure and Conditions: One-half of each area was limed in the spring of 1928 by the addition of enough limestone to bring the reaction of the soil to pH 6.5 plus and amount sufficient to neutralize the acid which would be developed by the nitrogenous fertilizers used for a period of four years. At the end of each four-year period, sufficient limestone is to be added to neutralize the acidity developed by the nitrogenous fertilizer for the ensuing four years.

Nitrogen was applied annually to all plots at the rate of 45 pounds per acre, with the exception of a single plot in each test which received no nitrogen. All of the plots received annually 96 pounds of phosphoric acid per acre except Plot 10 which received 195 pounds from Ammo-Phos A. Muriate of potash was applied to all plots at the rate of 100 pounds per acre. The phosphorus, potassium, and one-half of the nitrogen were applied only a few days before planting the cotton except for the plots which received Ammo-Phos A and calcium cyanamid; on these two plots, except in 1926 and 1927, all of the nitrogenous fertilizer was added from 10 to 14 days before planting. When nitrogen was used as a side dressing it was applied immediately after the cotton was thinned.

Calcium content of the limestone: 92% CaCO_3 .

Average planting date: About April 20.

Variety used each year: Cook.

Size of plots: 1/40 acre.

Width of rows: 3 feet.

Number of replications: Two.

Cover crops: None grown on this land during the period of the experiment.

The experiment has been run continuously on the same land, each plot following itself each year of the experiment. Boll weevil control measures were used some years.

Results:

Yield of Seed Cotton from Various Sources of Nitrogen on Unlimed and Limed Norfolk Sandy Loam

Pot No.	Source of Nitrogen	Limed Land					Unlimed Land					
		Pounds Limestone Per Acre	1928	1929	1930	4 Yr. Av.	1931	1930	1929	1931	4 Yr. Av.	
Yields in Pounds Seed Cotton												
1	Sodium nitrate	1100	1356	1040	966	1932	1188	884	944	978	1472	1096
2	Sodium nitrate ¾, ammonium sulphate ¼	1100	1168	1056	1048	1584	1214	1080	968	1633	1456	1134
3	Ammonium sulphate	2270	1200	1068	1119	1620	1252	1004	920	731	1360	1004
4	Leunasalpetor	1980	888	1064	832	1628	1103	716	1036	853	1484	1022
5	Sodium sulphate	1100	924	928	759	1740	1088	796	960	829	1632	1054
6	None	1100	384	432	452	704	493	256	320	387	672	409
7	Calcium cyanamid	1100	928	1000	840	1544	1078	740	996	928	1576	1060
8	Ammonium sulphate (basic slag)	1100	1204	1016	851	1544	1154	1032	988	910	1472	1100
9	Sodium nitrate	1100	1052	1012	854	1524	1110	860	1024	928	1544	1089
10	Ammo-Phos A	2270	1236	924	877	1572	1152	972	588	402	1508	867
11	Urea	1690	1348	1052	1020	1580	1250	936	1048	753	1588	1081
12	Sodium nitrate	1100	880	976	756	1528	1035	536	1028	792	1640	999
13	Sodium nitrate	1100	1344	996	925	1484	1187	1128	1048	1136	1544	1214
14	Calcium nitrate	1100	1240	1072	1141	1644	1274	1016	1108	1018	1620	1190
15	Cottonseed meal	1100	940	1024	936	1488	1097	972	1028	803	1384	1047
16	Sodium nitrate	1100	1128	1104	859	1672	1191	1020	1088	919	1664	1173
	Average sodium nitrate		1114	1009	853	1557	1133	871	1015	935	1583	1100

Reference: Alabama Agricultural Experiment Station Bulletin 238, pages 28, 29 and 30, tables 11 and 12, "Experiments with Commercial Nitrogenous Fertilizers," Auburn, Alabama.

ORGANIC VERSUS INORGANIC NITROGEN SOURCES FOR COTTON AT COLUMBUS, MISSISSIPPI

Conducted by: Mississippi Agricultural Experiment Station.

Conducted at: K. L. Spurlock's farm, Columbus, Mississippi.

Period: 1931-1934.

Purpose: To determine whether organic or inorganic nitrogen gives the best yields of cotton.

Soil: Cahaba.

Procedure and Conditions:

Fertilizers:

Organic source: Urea and cottonseed meal.

Inorganic source: Chilean nitrate of soda.

Size of plots: 1/50 acre.

Number of replications: Four.

Results:

Organic Versus Inorganic Nitrogen Sources for Cotton

600 Pounds 4-8-4 Per Acre from		Increase Over 600 Pounds 0-8-4 in Pounds Seed Cotton Per Acre				
Organic	Inorganic	1931	1932	1933	1934	Average
0	100	-124	366	399	504	286
50	50	-20	279	378	380	254
75	25	-53	298	433	457	284
100	0	96	293	385	444	304
100	B. S.*	153	176	307	460	274
	Milorganite**	127	360	318	471	319
	No fertilizer		-175	-183	-71	-143
Actual Yield with 600 Lbs. 0-8-4 per acre		612	555	726	662	639

*B. S.—Basic slag.

**Processed sewerage sludge.

Organic nitrogen sources are those containing carbon as an essential ingredient (not as carbonates). Originally the the organic sources were limited to plant and animal products, but now many of the organic sources are made chemically.

The following is a classification of some of the more common nitrogen sources:

ORGANIC: Cottonseed meal, urea, dried blood, tankage and fish scrap.

INORGANIC: Those with nitrogen alone are: Nitrate of soda (Chilean, Champion and Arcadian), Sulphate of ammonia, calcium cyanamid, calcium nitrate, leunasalpeter, cal nitro, and ammonium nitrate.

Those containing two plant nutrients are: Nitrophoska and ammophoska.

Reference: Record card of Mississippi Agricultural Experiment Station.

TIME OF APPLICATION OF NITRATE OF SODA TO COTTON

EFFECT OF TIME OF APPLICATION ON STAND, YIELD AND EARLINESS OF COTTON AT FAYETTEVILLE, NORTH CAROLINA

Conducted by: North Carolina Agricultural Experiment Station.

Conducted at: Fayetteville, North Carolina.

Period: 1931-1933.

Purpose: To compare the effects of nitrogen, applied at different times on stand, yield and earliness of cotton.

Soil: Ruston sandy loam.

Land History: Preceding the inauguration of the experiment the field had grown cotton in rotation with corn interplanted with soybeans. The vegetation produced by the soybeans was plowed under in the field for green manure. By this practice the soil had been maintained at a high level of fertility, and large yields of cotton were secured. The year preceding the inauguration of the experiment, the field was in corn and soybeans and a mass of vegetation from the soybean vines was turned under late in the fall. Cotton was grown continuously in the experiment for three years, each plot receiving identical fertilizer treatments each year, and no vegetation except cotton stalks was grown or turned under during the three year period.

Procedure and Conditions:

Source of phosphorus: Superphosphate containing 16% phosphoric acid.

Source of potash: Sulphate of potash containing 48% potash.

Methods of applying fertilizer in relation to bed: Applied in drill, stirred and covered so that when seed are planted fertilizer will be about three inches below seed. Delayed application made on the side of row by hand.

Average planting date: April 20.

Width of rows: 3½ feet.

Number of replications: Two.

Variety of cotton used: Coker's Farm Relief.

Results: Effect of Time of Application of Nitrogen on Stand, Yield, and Earliness of Cotton

Source of Nitrogen	Fertilizer Applied Per Acre			Yield in Pounds Seed Cotton Per Acre												A V E R A G E			
	Pounds N-P-K Applied at Planting	Lbs. Nitrogen Applied at		Total Pounds N-P-K Applied	1 9 3 1			1 9 3 2			1 9 3 3			Yield Per Acre	Cotton Open First Picking %	Area in Which Did Not Come Up %			
		Chop-ping	3 weeks After Chop-ping		Yield Per Acre	Cotton Open First Picking %	Yield Per Acre	Cotton Open First Picking %	Yield Per Acre	Cotton Open First Picking %									
Nitrate of Soda	48-64-64 24-64-64 16-64-64	0 24 16	0 0 16	48-64-64 48-64-64 48-64-64	2100 1975 1912	74 80 83	1437 1306 1480	55 52 58	2150 1675 1857	81 82 85	1896 1652 1750	70 71 75	13 13 12						
Sulphate of Ammonia	48-64-64 24-64-64 16-64-64	0 24 16	0 0 16	48-64-64 48-64-64 48-64-64	1975 1743 1755	76 82 81	1387 1299 1389	54 56 59	1788 1580 1788	84 87 88	1717 1541 1644	71 75 76	15 14 15						
Urea	48-64-64 24-64-64 16-64-64	0 24 16	0 0 16	48-64-64 48-64-64 48-64-64	1975 1906 1987	78 79 81	1437 1318 1300	54 56 53	1762 1572 1837	88 88 91	1725 1599 1708	73 74 75	15 12 11						
No fertilizer Average 3 plots					1025	89	762	60	870	67	886	72	4						

Reference: United States Department of Agriculture Technical Bulletin 452, page 24, table 11, "Experiments with Nitrogen Fertilizers on Cotton Soils," October 1934, Washington, D. C.

THE EFFECT OF FERTILIZER ON THE EARLINESS OF COTTON IN LOUISIANA

Conducted by: Louisiana Agricultural Experiment Station.

Conducted at: Baton Rouge, Louisiana.

Period: Five years.

Purpose: To determine what effect the common fertilizer ingredients would have on earliness of cotton when used under field conditions.

Soil: Lintonia silt.

Procedure and Conditions: For five years during the main blooming period, daily bloom counts were made on 28 plots in the general fertilizer experiment.

It will be observed that the high application of phosphorus fertilizer increased the blooming rate for the first four weeks and gave the highest percentage of yield at the first picking but not the highest total yield.

The high nitrogen application increased the blooming rate over no-nitrogen throughout the whole period and increased total yields. Nitrogen is the fertilizer most needed on this soil. The percentage of cotton the first picking was higher on the no-nitrogen plots than on the high-nitrogen due to the fact that the less vigorous plants stopped fruiting sooner.

The high application of potash reduced the blooming rate the first week, compared with the no-potash, but the total blooming and yield of cotton were increased. Potash is badly needed on this land.

The no-fertilizer plots, as was to be expected, had the lowest blooming rate and made lowest yields.

From the results of this experiment, it appears that phosphorus does increase earliness to some degree and potash decreases it, but the decrease may be more than balanced by the benefit shown later in increased growth and production.

Results:

Effect of Fertilizers on Earliness of Cotton Yield Per Plot

Fertilizer Treatment	Blooms first week	Blooms second week	Blooms third week	Blooms fourth week	Blooms fifth week	Yields seed cotton	Pct. first picking
No phosphorus	714	1589	1479	1911	1921	66.8 lb	47
Total blooms to date	.....	2305	3782	5693	7614	.....	....
High phosphorus	1228	2561	1854	1953	1682	74.3 lb	65
Total blooms to date	.....	3789	5643	7596	9278	.....	....
No nitrogen	741	1534	1340	1461	1385	55.2 lb	59
Total blooms to date	.....	2275	3615	5076	6461	.....	....
High nitrogen	956	1904	1542	1630	1697	76.4 lb	54
Total blooms to date	.....	2860	4402	6032	7729	.....	....
No potash	929	1764	1594	1771	1563	65.8 lb	59
Total blooms to date	.....	2693	4287	6058	7621	.....	....
High potash	864	1944	1575	1894	1652	82.2 lb	53
Total blooms to date	.....	2898	4383	6277	7929	.....	....
No fertilizer	590	1371	1216	1468	1322	47.4 lb	52
Total blooms to date	.....	1961	3177	4645	5967	.....	....

Reference: Louisiana Agricultural Experiment Station Bulletin 283, pages 9 and 10, table 2, "Crops and Soils Information," March 1937, Baton Rouge, Louisiana.

TIME OF APPLYING FERTILIZER TO COTTON IN SOUTH CAROLINA

Conducted by: South Carolina Pee Dee Branch Experiment Station.

Conducted at: Florence, South Carolina.

Period: 1934-1936.

Purpose: To determine what effect the time of applying fertilizer has on the yield of cotton.

Procedure and Conditions: In these tests fertilizer was applied as follows: All previous to planting, one-half previous to planting, phosphorus only before planting, and none before planting.

Results:

Effect of Time of Applying Fertilizer on Yield of Seed Cotton

Treatment	Yield in Pounds Seed Cotton Per Acre			
	1934	1935	1936	Average
All applied previous to planting	2022	2095	2006	2041
One-half applied previous to planting	2005	2118	2263	2128
Phosphorus only before planting	2067	1962	2245	2091
None before planting—all at chopping	1890	1746	1959	1865

Reference: South Carolina Agricultural Experiment Station Forty-Ninth Annual Report, page 75, table 33, December 1936, Clemson, South Carolina.

TIME OF APPLYING NITRATE OF SODA TO COTTON AT NATCHEZ, MISSISSIPPI

Conducted by: Natchez Branch Experiment Station.

Conducted at: Natchez, Mississippi.

Period: 1934-1937.

Purpose: To determine the best time to apply nitrate of soda to cotton.

Results:

Time of Applying Nitrate of Soda to Cotton

Treatment	Yield in Pounds Seed Cotton Per Acre				
	1934	1935	1936	1937	Average
Check—no nitrate of soda	266	174	231	251	230
100 lbs. under before planting	282	269	415	456	353
200 lbs. under before planting	381	364	494	565	451
100 lbs. side dressing, cotton 40 days old	284	250	288	401	306
200 lbs. side dressing, cotton 40 days old	340	298	347	448	359
100 lbs. under before planting					
100 lbs. side dressing, cotton 40 days old	327	296	413	503	385

Reference: Mississippi Agricultural Experiment Station Information Sheet 141, "Cotton Fertilization," January 1938, State College, Mississippi.

PHOSPHORUS SOURCES

PHOSPHORUS SOURCES TEST AT HOLLY SPRINGS, MISSISSIPPI

Conducted by: Holly Springs Branch Experiment Station.

Conducted at: Holly Springs, Mississippi.

Period: 1929-1934.

Purpose: To determine the best source of phosphorus fertilizer for cotton.

Soil: Lintonia silt loam.

Procedure and Conditions:

Fertilizer:

Source of nitrogen: Nitrate of soda containing 15% nitrogen, 1934, 16% nitrogen.

Source of potash: Muriate containing 50% potash.

Date of applying fertilizer in relation to planting date: A few days prior to planting.

Average planting date: May 8.

Earliest planting date during test: May 2.

Latest planting date: May 22.

Variety used each year: Stoneville No. 2 through 1930. Stoneville No. 3 to date.

Method of applying fertilizer in relation to the bed: In shovel furrow in list.

Size of plots: 1/20 acre.

Number of replications: Three except in 1933, two then.

Width of rows: 40 inches.

Cover crops: None grown during the period of the experiment.

Boll weevil control measures used: In 1933, one application at proper time; in 1934, three applications.

The experiment has been run continuously on the same land, each plot following itself each year of the experiment.

Results:

Phosphorus Sources Test

Phosphatic Fertilizers Applied	Increase Over no Phosphorus					
	1929	1930	1931*	1933	1934	Average
300 lbs. superphosphate	73	5	206	364	113	152
300 lbs. basic slag	...	..	.....	180	100	.....
300 lbs. Rhum's phosphate	65	45	65	.....	111	71**
300 lbs. Colloidal phosphate	50	-60	25	152	57	44
No phosphorus (actual yield)	918	954	570	762	858	812
No fertilizer, average three plots, (Actual yield)	.....	825	295	609	718	611**

Each plot including check, received 36 pounds each of nitrogen and potash per acre.

*No experiment run in 1932 due to lack of funds.

**Four year average.

Reference: Records from Holly Springs Branch Experiment Station, Holly Springs, Mississippi.

PHOSPHORUS SOURCES TEST FOR COTTON AT NATCHEZ, MISSISSIPPI

Conducted by: Natchez Branch Experiment Station.

Conducted at: Natchez, Mississippi.

Period: 1929-1931.

Purpose: To determine the best source of phosphorus fertilizer for cotton.

Soil: Memphis silt loam.

Procedure and Conditions:

Fertilizers:

Source of nitrogen: Nitrate of soda containing 15% nitrogen.

Source of potash: Muriate of potash containing 50% potassium.

Date of applying fertilizer: Five or 10 days before planting.

Method of applying fertilizer: Spread in drill, cotton planted over fertilizer.

Date of planting: About April 15.

Spacing of plants in drill: Approximately 4 plants to the foot.

Size of plot: 6/100 acre.

Width of row: 40 inches.

Number of replications: Four.

Variety of cotton used: D. & P. L. No. 4.

Boll weevil control measures used: 1929, 3 applications, approximately 6 pounds per acre. 1930, 2 applications, 7 pounds each application. 1931, 3 applications, 7 pounds each application.

The test has been run continuously on the same land. Before the experiment was begun the average yield of corn per acre without fertilizer was 20 bushels. The yield of seed cotton without fertilizer was 800 pounds.

Results:

Phosphorus Sources Test for Cotton*

Source	Yield in Pounds Seed Cotton Per Acre			
	1929	1930	1931	Average
16% superphosphate	1142	786	1380	1103
Rhum's phosphate	1100	772	.....	936
Basic slag			1594	
No phosphate	1046	778	1373	1077

*Enough of each phosphorus source was added to give 48 lbs. of phosphoric acid on each plot.

Reference: Records from Natchez Experiment Station, Natchez, Mississippi.

PHOSPHORUS SOURCES TEST FOR COTTON AT RAYMOND, MISSISSIPPI

Conducted by: Raymond Branch Experiment Station.

Conducted at: Raymond, Mississippi.

Period: 1929-1931.

Purpose: To determine the best source of phosphorus fertilizer for cotton.

Soil: Olivier silt loam.

Procedure and Conditions:

Date of applying fertilizer: 1929, April 9; 1930, April 29; 1931, April 30.

Method of applying fertilizer: In bottom of bed and bedded on.

Date of planting: 1929, May 2; 1930, May 1; 1931, May 1.

Spacing of plants in drill: 3 stalks every foot.

Size of plots: 1/20 acre.

Width of rows: 3½ feet.

Number of replications: 10.

Variety of cotton used: 1929, Lone Star 65; 1930, Lone Star 65; 1931, Lone Star 561.

Results:

Phosphorus Sources Test for Cotton at Raymond, Mississippi

Phosphorus Source	Pounds N-P-K Per Acre	Equivalent to 508 Lbs. of	Increase over no phosphorus in Lbs. seed cotton per acre			
			1929	1930	1931	Average
Superphosphate	30½-61-30½	6-12-6	234	52	440	242
Rhum's phosphate	30½-122-30½	6-24-6	69	-26	124	56
Ammophoska	30½-61-30½	6-12-6	49	83	-208	-25
Superphosphate	30½-61-30½	6-12-6	234	84	346	221
None—actual yield	30½-0-30½	6-0-6	1112	1390	1147	1216

Test discontinued after 1931.

Reference: Record cards of the station.

POTASH SOURCES

POTASH SOURCES TEST WITH COTTON AT RAYMOND, MISSISSIPPI

Conducted by: Raymond Branch Experiment Station.

Conducted at: Raymond, Mississippi.

Period: 1929-1934.

Purpose: To determine the best source of potash fertilizer for cotton.

Soil: Olivier silt loam.

Procedure and Conditions:

Fertilizer used:

Nitrogen source: Chilean nitrate of soda.

Phosphorus source: 16% and 20% superphosphate.

Available potash applied per acre: 48 pounds.

Dates of applying fertilizer: 1928, April 22; 1929, April 22; 1930, May 2; 1931, April 29; 1933, April 24; 1934, April 14.

Date of planting: 1928, May 1; 1930, May 3; 1931, planted April 30, planted over May 18 and again May 28; 1932, May 4; 1933, May 4; and 1934, April 20.

Size of plot: 1/20 acre.

Width of rows: 3½ feet.

Number of replications: 4.

Variety of cotton used: 1929-1931, Lone Star 168; 1932-33, Lone Star 561; 1934, Starfos.

Poison applications: 1929, 3 application; 1930, on August 1, and August 9, to control army worm. In 1933, poison was applied twice, and 3 times in 1934.

Results:

Potash Sources Test with Cotton

48-96-48 Lbs. N-P-K or 800 Lbs. 6-12-6 from	Increase over no potash in Lbs. Seed Cotton per A.						
	1929	1930	1931	1932	1933	1934	Average
Kainit	229	659	180	608	460	339	412
Muriate of potash	277	563	325	421	626	193	401
Sul. pot. magnesia	354	666	273	528	626	331	463
Sulphate of potash	327	769	278	529	794	169	478
Manure salt	267	566	281	407	469	336	388
No potash 6-12-0 (actual yield)	1673	1605	1233	1440	1476	1179	1434
No fertilizer	-497	-484	-323	-382	-279	-681	-433

Reference: Record cards from Raymond Branch Experiment Station, Raymond, Mississippi.

COTTON POTASH SOURCES TEST AT HOLLY SPRINGS, MISSISSIPPI

Conducted by: Holly Springs Branch Experiment Station.

Conducted at: Holly Springs, Mississippi.

Period: 1926-1936.

Purpose: To determine the best source of potash fertilizer for cotton.

Soil: 1926-27-28, unimproved sandy loam valley land, Lintonia silt loam. 1929 and since, thin level brown loam (Memphis silt loam) that has been grown to cotton for fifty years with little if any improvement methods used.

Procedure and Conditions:

Fertilizer: 1926-1928, all plots, including checks received 300 pounds superphosphate and 150 pounds nitrate of soda per acre. The potash carriers were applied at such rate as to provide 24 pounds of available potash per acre.

1929-34, 36 pounds available potash per acre on the potash plots, while all plots received 240 pounds nitrate of soda and 450 pounds superphosphate.

1934-36, 24 pounds of available potash per acre was used. The nitrogen and phosphorus was not changed and the amount of total fertilizer was equivalent to 400 pounds 6-12-6 per acre.

Date of applying fertilizer: 1927, May 18; 1928, May 14.

Size of plots: 1/20 acre.

Width of rows: 3½ feet.

Number of replications: 3.

Variety of cotton used: 1926-27, Miss. Station Trice; 1928, Lone Star 79.

Results:

Potash Sources with Cotton at Holly Springs, Mississippi

Potash Sources	Increase Over No Potash in Pounds Seed Cotton Per Acre										
	1926	1927	1928	1929	1930	1931	1933	1934	1935	1936	Average
14% kainit	362	76	302	102	114	113	69	.....	.....	.....	162
50% muriate	351	201	132	93	123	118	44	17	146	152	138
50% sulphate potash	150	98	64	36	64	101	103	—25	180	117	89
20% manure salt	.....	.....	.....	87	31	6	107	19	224	112	83
Trono	19	219	169	59	61	—35	.....	.....	.....	.....	82
No fertilizer	.....	.....	.....	—373	—338	—631	—533	—275	—177	—185	—359
Actual yield—no potash	1571	1027	1383	826	796	854	1056	782	764	788	985

Reference: Records from Holly Springs Branch Experiment Station.

POTASH SOURCES TEST FOR COTTON AT POPLARVILLE, MISSISSIPPI

Conducted by: Poplarville Branch Experiment Station.

Conducted at: Poplarville, Mississippi.

Period: 1926-1930.

Purpose: To determine the best source of potash fertilizer for cotton.

Soil: Ruston fine sandy loam.

Procedure and Conditions:

Method of applying fertilizer: Applied in water furrow and bedded on.

Date of applying fertilizer: 1927, April 1-10; 1929, April 10; 1930, March 25.

Planting date: 1927, April 1-10; 1929, April 25; 1930, April 21.

Spacing of plants in drill: Hoe width.

Size of plots: 1/20 acre.

Width of rows: 3½ feet.

Number of replications: Three.

Variety of cotton used: 1927, Lone Star 65; 1929, D. & P. L. 5242A-310-46; 1930, D. & P. L. station selected.

Poison applied: 1927, 3 applications.

Results:

Potash Sources Test for Cotton at Poplarville, Mississippi

24-48-24 Lbs. N-P-K Per Acre of 600 Lbs. 4-8-4* from					
	1926	1927	1929	1930	Average
Muriate of potash	—44	207	220	76	115
Sulphate of potash	8	74	338	84	126
Kainit	49	169	158	250	156
Manure salt		84	155	116	102**
Kemfert (Trona)	11	74	68	***	51
Yield per acre from 600 lbs. 4-8-0	1003	676	1142	920	935

*Changed to 800 pounds 4-8-4 in 1929, or 32-64-32 pounds N-P-K.

**3-year average.

***Unable to obtain Trona in 1930.

The test was not reported in 1928 due to poor stand caused from "damping off."

Reference: Records from South Mississippi Branch Experiment Station, Poplarville, Mississippi.

EFFECT OF VARIOUS POTASH SOURCES ON COTTON WILT AT POPLARVILLE, MISSISSIPPI

Conducted by: South Mississippi Branch Experiment Station.

Conducted at: Poplarville, Mississippi.

Period: 1928-1931.

Purpose: To determine the effect of various potash sources on cotton wilt.

Soil: Ruston fine sandy loam.

Procedure and Conditions: The soil on which the experiment was run was inoculated with wilt culture each year.

Method of applying fertilizer: Distributed in water furrow and bedded on.

Average planting date: April 10 to 20.

Earliest planting date during the test: April 3.

Latest planting date during the test: April 21, except in 1928 when it was planted over the third time on May 4.

Spacing of plants in drill: 8 to 9 inches.

Size of plots: 1/20 acre.

Width of rows: 3½ feet.

Number of replications: 3.

Variety used each year: Cleveland 54 in 1928. Other years, station selection of D. & P. L. (5242A-310-46).

Boll weevil control measures used: Two or 3 applications of calcium arsenate dust of 3 to 4 pounds each have been applied each year.

The experiment has been run continuously on the same land, each plot following itself each year of the experiment. A cover crop of oats has been grown each year.

Results:

Effect of Various Potash Sources on Cotton Wilt

Source of Potash	Increase Over No Potash in Lbs. Seed Cotton Per A.				
	1928	1929	1930	1931	Average
Muriate of potash	-75	67	115	179	71
Sulphate of potash	-55	69	156	82	63
Kainit	-74	36	157	138	64
Manure salt	-41	-32	90	48	16
None—actual yield from 800 lbs. 6-8-0	638	1465	1025	1059	1047

Reference: Records from South Mississippi Branch Experiment Station, Poplarville, Mississippi.

EFFECT OF POTASH FERTILIZER ON COTTON WILT AT POPLARVILLE, MISSISSIPPI

Conducted by: South Mississippi Branch Experiment Station.

Conducted at: Neal Field, Poplarville, Mississippi.

Period: 1927-1931.

Purpose: To determine the effect of potash fertilizer on cotton wilt.

Soil: Ruston fine sandy loam.

Procedure and Conditions: The soil on which this test was conducted was inoculated with fungus each year.

Fertilizer:

Source of nitrogen: Nitrate of soda containing 16% nitrogen.

Source of phosphorus: Superphosphate containing 16% phosphoric acid.

Method of applying fertilizer in relation to bed: Applied in the water furrow and bedded on.

Average planting date: April 10 to 20.

Latest planting date: Last week in April.

Earliest planting date: First week in April.

Spacing of plants in drill: 8 to 10 inches.

Size of plots: 1/20 acre.

Width of rows: 3½ feet.

Oats have been grown as a cover crop each year of the test. Boll weevil control measures were used during the test.

Results:

Effect of Potash Fertilizer on Cotton Wilt at Poplarville, Miss.

Source of Potash	Pounds N-P-K Per Acre	Equivalent to 600 lbs. Per Acre of	Increase Over No Potash in Pounds Seed Cotton Per Acre					
			1927	1928	1929	1930	1931	Average
Muriate of potash	36-48-48	6-8-8	448	177	450	0	71	229
Sulphate of potash	36-48-48	6-8-8	290	149	825	76	89	286
Manure salt	36-48-48	6-8-8	367	218	870	102	171	346
Kainit	36-48-48	6-8-8	424	257	573	153	149	311
Muriate of potash	36-48-24	6-8-4	347	132	465	68	90	220
Muriate of potash	36-48-60	6-8-10	403	83	—102	153	—10	105
Muriate of potash	36-48-72	6-8-12	288	43	—102	102	116	90
None — actual yield	36-48-0	6-8-0	*	500	966	1156	1122	936
No fertilizer	None	0-0-0	—325	—95	—669	—298	*	—354

*No yield recorded.

Reference: Records from South Mississippi Branch Experiment Station, Poplarville, Mississippi.

POTASH SOURCES TEST WITH COTTON IN GEORGIA

Conducted by: Georgia Coastal Plain Experiment Station.

Conducted at: Tifton, Georgia.

Purpose: To compare the principal sources of potash.

Soil: The cotton work at the Georgia Coastal Plain Experiment Station has been largely on a typical Tifton sandy loam with work also being done on a light phase of Tifton sandy loam which very closely resembles Norfolk sandy loam. The results of this work, therefore, should be applicable to both Tifton and Norfolk soil types.

Procedure and Conditions:

Fertilizer: In this test each area received 600 pounds of 2½-9-5 fertilizer (15-54-30 pounds N-P-K) applied at time of planting.

Source of nitrogen: Nitrate of soda containing 15% nitrogen.

Source of phosphorus: Superphosphate containing 16% phosphoric acid.

Method of applying fertilizer in relation to the bed: Applied to row, bedded on.

Date of applying fertilizer in relation to planting date: Ten days or two weeks in advance.

Average planting date: April 1.

Size of plots: 1/20 acre.

Width of rows: 3.3 feet.

Number of replications: Two.

Boll weevil control measures used: Mopped once using about two pounds calcium arsenate per acre.

The experiment has not been run continuously on the same land.

Results:

Potash Sources Test with Cotton in Georgia

Source of Potash	Yield in Pounds Seed Cotton Per Acre											Average
	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	
Kainit	733	1105	1436	1202	1415	1330	1310	1585	1140	1059	1372	1244
Sulphate of potash	662	1086	1428	1222	1422	1123	1348	1537	996	1188	1390	1218
Muriate of potash	621	1048	1321	1206	1385	1195	1290	1415	993	980	1275	1157
Manure salts	656	1107	1143	1139	1250	1130	1345	1582	964	.....	.....	1146*
No potash	433	770	950	735	742	642	880	598	650	586	1180	742

*9-year average.

Reference: Georgia Coastal Plain Experiment Station Bulletin 24, page 19, table 8, "Fourteenth Annual Report," June 1934, Tifton, Georgia.

MANURE

COMMERCIAL FERTILIZER VERSUS STABLE MANURE WITH COTTON AT POPLARVILLE, MISSISSIPPI

Conducted by: South Mississippi Branch Experiment Station.

Conducted at: Poplarville, Mississippi.

Period: 1933-1935.

Purpose: To compare commercial fertilizer with stable manure on cotton

Procedure and Conditions: The fertilizer has been used in even amounts of two to twelve tons of stable manure per acre with adjacent plots containing from 200 to 1200 pounds of 6-8-4 commercial fertilizers.

Results:

Commercial Fertilizer Versus Stable Manure for Cotton

Treatment	Increase Over Check in Pounds Seed Cotton Per Acre				Pounds Seed Cotton Per Acre 1935
	1933	1934	1935	Average	
Check					138
200 Lbs. 6-8-4	248	172	162	194	306
2 tons stable manure	234	238	437	302	386
400 pounds 6-8-4	460	222	345	342	500
4 tons stable manure	394	444	583	472	744
600 pounds 6-8-4	548	412	430	463	596
6 tons stable manure	388	456	572	472	744
Check					
800 pounds 6-8-4	454	470	554	178	726
8 tons stable manure	474	316	668	486	835
1000 pounds 6-8-4	540	438	267	415	428
10 tons stable manure	508	608	911	676	1057
1200 pounds 6-8-4	700	412	483	532	632
12 tons stable manure	694	638	1226	853	1370
Check					

Reference: Agricultural Education Bulletin Volume 14, Numbers 5 and 6, 7 and 8, "Quadrennial Report of the South Mississippi Branch Experiment Station, December 1935, State College, Mississippi.

COMPARATIVE YIELDS OF SEED COTTON FROM THE USE OF MANURE AND A COVER CROP OF RYE AND VETCH IN SOUTH CAROLINA

Conducted by: South Carolina Agricultural Experiment Station.

Conducted at: Clemson College Farm, Clemson, South Carolina.

Period: 1926-1935.

Purpose: To determine the value of a cover crop of rye and vetch compared with fresh manure from the dairy barn in the production of cotton.

Procedure and Conditions: In this study each of the four plots has received annually the same amount of commercial fertilizer (approximately 600 pounds of 4-8-4 fertilizer, plus 100 pounds of nitrate of soda), but in addition Plot 2 has received eight tons of fresh manure per acre; Plot 3, a cover crop of rye and vetch turned under about two weeks before planting; and Plot 4, eight tons of fresh manure and a cover crop of rye and vetch.

The productivity was approximately the same on each of the four plots when the study was started.

Results:

Comparative Yields of Seed Cotton From the Use of Manure and
a Cover Crop of Rye and Vetch in South Carolina

Treatment	Yield in Pounds Per Acre									Increase over Check
	1926	1929	1930	1931	1932	1933	1934	1935	Average	
No manure or cover crop	470	800	1020	865	1700	1260	1200	1920	1154	
8 tons manure	610	1060	1340	1035	2046	1950	1700	2034	1472	318
Rye and vetch cover crop	470	1060	1000	1175	1902	1710	1480	1960	1345	191
8 tons manure rye and vetch cover crop	775	1330	1750	1575	2588	1860	2040	2750	1834	680

In 1927 and 1928 the stand of cotton was poor on all plots and no yield records were kept.

Reference: South Carolina Agricultural Experiment Station Forty-Ninth Annual Report, page 62, table 24, December 1936, Clemson, South Carolina.

THE EFFECT OF STABLE MANURE ON YIELD OF COTTON IN SOUTH CAROLINA

Conducted by: South Carlonia Pee Dee Branch Experiment Station.

Conducted at: Florence, South Carolina.

Period: 1930-1933.

Purpose: To determine the effect of varying amounts (one to five tons) stable manure on the production of cotton.

Procedure and Conditions: Manure of good quality, which was practically free of straw and litter, has been used each year and thoroughly mixed with the soil about two weeks previous to planting. Extremely dry weather prevailed each year during the growing period.

Results:

Yields of Seed Cotton Obtained with Varying Amounts of Stable Manure

Treatment	Pounds Seed Cotton Per Acre			Average Yield Three Years
	1934	1935	1936	
No manure—425 pounds fertilizer	1730	1835	2205	1923
Manure 2 tons—no fertilizer	1811	1884	2027	1907
Manure 1 ton—425 pounds of fertilizer	1823	1964	2238	2008
Manure 3 tons—425 pounds of fertilizer	1804	2098	2515	2139
Manure 5 tons—425 pounds of fertilizer	1895	2114	2659	2222

Reference: South Carlonia Agricultural Experiment Station Forty-Ninth Annual Report, page 77, table 35, December 1936, Clemson, South Carolina.

PLACEMENT

FERTILIZER PLACEMENT STUDIES AT WEIR, MISSISSIPPI

Conducted by: Mississippi Agricultural Experiment Station in cooperation with National Fertilizer Association and United States Bureau of Agricultural Engineering.

Conducted at: Weir, Mississippi.

Period: 1934-1936.

Purpose: The objects of these investigations were (1) to study the influence of fertilizer placement in different positions with respect to the seed upon germination, stand, and yield of cotton; (2) to compare mechanical application of fertilizer with local practices; (3) to compare application of fertilizer at seeding time with pre-application; (4) to study the influence of different rates of fertilization upon the method of application.

Soil: Ruston fine sandy loam.

Procedure and Conditions: The machine used in these studies was a special built planter with fertilizer attachments made by the United States Bureau of Agricultural Engineering. The machine was constructed in such manner that a few minor changes would allow the placement of the fertilizer in any desired position with regard to the seed.

Six replications of the series of tests were conducted each year. Rows were 100 feet long, divided into two sections of 50 feet each, thus making 12 replications on one row plots 50 feet long. Yields for certain tests and germination data are not reported.

Attention is called to the fact that in the description of the treatment as shown in the table, different width bands of fertilizer were used. "1.75 band" means the fertilizer was placed in a strip or band 1.75 inches wide without considering the seed position, while "band 1.5" to each side, 2" below seed means the fertilizer was placed 1.5 inches from the seed on each side and 2 inches deeper than the seed.

Results: Fertilizer Placement Studies with Cotton

Placements	Yield in Lbs. Seed Cotton Per Acre				
	1934	1935	1936	Average	Increase over Av. Check
1.75" band—800 pounds 4-8-4					
1" below seed	1032	913	542	827	381
2" below seed	1018	1112	867	979	533
3" below seed	983	1106	1180	1089	643
4" below seed	931	1224	1129	1061	615
1.5" to one side, 2" below seed	983	1153	1156	1097	651
3.5" to one side, 2" below seed	879	1056	1248	1061	615
1.5" to one side, 2" below seed	991	1116	1117	1075	629
2.5" to one side, 1" below seed	1021	1039	1309	1123	677
2.5" to one side, 2" below seed	1001	1083	1435	1173	727
2.5" to one side, 3" below seed	976	1159	1418	1184	738
3.5" to one side, 2" below seed	918	1164	1423	1168	722
1/16 fertilizer in contact, balance in band					
2.5" to each side, 2" below seed	1038	1091	1489	1206	760
¼ fertilizer in surface soil, balance in band					
2.5" to each side, 2" below seed	1018	1170	1469	1219	773
Mixed with soil to a depth of 3"	936	985	839	920	474
1.75" band—400 pounds per acre 4-8-4					
3" below seed	719	954	1051	908	462
1.5" to each side, 2" below seed	729	911	1041	894	448
2.5" to each side, 2" below seed	739	830	1259	942	496
1.75" band—1200 pounds per acre 4-8-4					
3" below seed	1059	1280	822	1053	607
1.5" to each side, 2" below seed	1093	1257	1291	1214	768
2.5" to each side, 2" below seed	1115	1255	1711	1360	914
Unfertilized check					
X—soil disturbed below seed	336	448	567	450	4
Y—soil undisturbed below seed	368	506	603	492	46
Z—soil undisturbed on land bedded 10 days before planting	348	425	411	395	—51
1.75" band—800 pounds 4-8-4 applied and land bedded 10 days before planting					
Fertilizer applied in two bands 6" apart 2"					
below seed level	854	1021	1197	1024	578
Fertilizer applied 3" below seed level	953	1116	1395	1155	709
Mixed with soil below seed level 3" depth	986	1014	1147	1049	603
Land bedded—fertilizer applied in bands					
2.5" to each side 2" below seed at planting	996	1095	1556	1216	770
Land bedded—fertilizer applied 3" under seed at planting (bed opened)	943	1151	1152	1082	636

Reference: Mississippi Agricultural Experiment Station Information Sheets 89 and 132, "Fertilizer Placement Studies—Cotton," December 1935, and December 1937, State College, Mississippi.

FERTILIZER PLACEMENT STUDIES AT STATE COLLEGE, MISSISSIPPI

Conducted by: Mississippi Agricultural Experiment Station in cooperation with National Fertilizer Association and United States Bureau of Agricultural Engineering.

Conducted at: State College, Mississippi.

Period: 1931-1933.

Purpose: The object of these investigations were (1) to study the influence of fertilizer placement in different positions with respect to the seed upon germination, stand, and yield of cotton; (2) to compare mechanical application of fertilizer with local practices; (3) to compare application of fertilizer at seeding time with pre-application; (4) to study the influence of different rates of fertilization upon the method of application.

Soil: Ochlockonee fine sandy loam.

Procedure and Conditions: The machine used in these studies was a special built planter with fertilizer attachments made by the United States Department of Engineering. The machine was constructed in such a manner that a few minor changes would allow the placement of the fertilizer in any desired position with regard to the seed.

Six replications of the series of tests were conducted each year. Rows were 100 feet long, divided into two sections of 50 feet each, thus making 12 replications on one row plots 50 feet long. Yields for certain tests and germination data are not reported.

Attention is called to the fact that in the description of the treatment as shown in the table, different width bands of fertilizer were used. "1.75 band" means the fertilizer was placed in a strip or band 1.75 inches wide without considering the seed position, while "band 1.5" to each side, 2" below seed means the fertilizer was placed 1.5 inches from the seed on each side and 2 inches deeper than the seed.

Results:

Fertilizer Placement Studies with Cotton

Placements	Yield in Lbs. Seed Cotton Per Acre				
	1931	1932	1933	Average	Increase over Av. Check
No fertilizer average	905	1114	516	845	
1.75" band—800 pounds 4-8-4					
1" below seed	1160	1476	653	1096	251
2" below seed	1005	1114	632	917	72
3" below seed	1130	1159	615	968	123
5" below seed			681		
3.5" band—800 pounds 4-8-4 per acre					
1" below seed	1235	1504	683	1141	296
2" below seed	1081	1289	592	987	142
3" below seed	1005	1211	653	973	128
1.75" band					
Band 1.5" to one side, 2" below seed			663		
Band 3.5" to one side, 2" below seed			658		
Band 1.5" to each side, 1" below seed	1237	1298	780	1105	260
Band 1.5" to each side, 2" below seed	1197	1314	782	1098	253
Band 1.5" to each side, 3" below seed	1097	1272	671	1013	168
Band 3.5" to each side, 1" below seed	1152	1295	706	1051	206
Band 3.5" to each side, 2" below seed	1180	1218	709	1036	191
Band 3.5" to each side, 3" below seed	1162	1245	640	1016	171
1/16 fertilizer in contact with seed					
1/16 fertilizer in band 3.6" to each side					
2" below seed		1284	726		
1/8 fertilizer in contact with seed					
7/8 in 1.75" band 3" below seed	909		447		
7/8 in band 3.5" to each side, 2" below seed	1068	1313	516	966	121
1/4 fertilizer on surface					
3/4 in band 3.5" to each side, 2" below seed	928		826		
Mixed with soil below seed	1090	1230	719	1013	168
Unfertilized checks					
Soil stirred 1.75" wide, 2" below seed	854	1247	577	893	48
Soil undisturbed for 3.5" to each side of seed	926	1053	538	839	—6
Soil stirred 3.5" wide, 2" below seed	936	1041	432	803	—42
1.75" band—200 pounds 8-16-8 per acre					
2" below seed	1013	1250	678	980	135
Band 3.5" to each side, 2" below seed	1006	1264	665	978	133
Mixed with soil below seed	913	1204	688	935	90
1.75" band—400 pounds 8-16-8 per acres					
2" below seed	1041	1237	693	990	145
Band 3.5" to each side, 2" below seed	1078	1333	719	1043	198
Mixed with soil below seed	1048	1300	696	1015	170
1.75" band—600 pounds 8-16-8 per acre					
2" below seed	969	1052	610	877	32
3.5" to each side, 2" below seed	1118	1350	721	1063	218
Mixed with soil below seed	1051	1329	653	1011	166

Reference: Mississippi Agricultural Experiment Station Information Sheet

FERTILIZER PLACEMENT TEST WITH SINGLE STRENGTH AND DOUBLE STRENGTH FERTILIZERS

Conducted by: State Experiment Stations in North Carolina, South Carolina in cooperation with the Bureau of Plant Industry, United State Department of Agriculture.

Conducted at: Columbia, Florence and Clemson College, South Carolina, and Rocky Mount, North Carolina.

Period: 1930-1933.

Purpose: To compare the effects of various placements of single strength and double strength fertilizers on different soils.

Soil: Norfolk coarse sand at Columbia, South Carolina.

Norfolk fine sandy loam at Florence, South Carolina.

Cecil sandy clay loam at Clemson College, South Carolina.

Norfolk sandy loam at Rocky Mount, North Carolina.

Procedure and Conditions: Three fertilizer placements were used and each was replicated six times. The experiments were not conducted on the same fields each year.

Both the single strength and double strength fertilizers were made from standard fertilizer materials and contained calcium and magnesium. The single-strength fertilizer, a 4-8-4 mixture, was applied at the rate of 800 pounds to the acre. The double-strength, 8-16-8, was applied at the rate of 400 pounds to the acre. All fertilizer was applied at planting time.

Results:

The Effects of Different Fertilizer Placements on Germination and Yields of Cotton with Single-strength and Double-strength Fertilizer

Fertilizer Placement	Single-strength Fert. (800 lbs. 4-8-4) (per acre)		Double-strength Fert. (400 lbs. 8-16-8) (per acre)	
	Number plants per 50 ft.	Pounds seed cotton per A.	Number plants per 50 ft.	Pounds seed cotton per A.
Norfolk Coarse Sand, Columbia, South Carolina				
1¾" band, 2" below seed	97	346	146	466
2¼" to each side, 2" below seed	397	616	385	577
Mixed with soil below seed	212	535	290	488
No fertilizer	395	197	405	169
Norfolk Fine Sandy Loam, Florence, South Carolina				
1¾" band, 2" below seed	112	1074	133	1093
2¼" to each side, 2" below seed	330	1490	342	1772
Mixed with soil below seed	187	1399	205	1408
No fertilizer	346	1341	343	1374
Cecil Sandy Clay Loam, Clemson College, South Carolina				
1¾" band, 2" below seed	344	1043	385	981
2¼" to each side, 2" below seed	436	928	446	1061
Mixed with soil below seed	318	1022	422	933
No fertilizer	450	653	446	786
Norfolk Sandy Loam, Rocky Mount, North Carolina				
1¾" band, 2" below seed	153	1182	170	1380
2¼" to each side, 2" below seed	314	1594	298	1570
Mixed with soil below seed	161	1454	261	1638
No fertilizer	277	971		

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Reference: Agricultural Education Bulletin, Volume 14, Numbers 5 and 6, pages 81 and 82, table 18, Clemson, South Carolina.

FERTILIZER PLACEMENT TEST WITH FERTILIZER APPLIED BEFORE AND AT PLANTING

Conducted by: National Joint Committee on Fertilizer Application in co-operation with the Georgia Experiment Station.

Conducted at: Georgia Experiment Station, Experiment, Georgia.

Period: Six years, 1928-1933.

Purpose: To study different fertilizer placements applied to cotton prior to planting time.

Soil: Cecil sandy clay loam.

Procedure and Conditions: Each acre received 800 pounds of 4-8-4 fertilizer derived from the following sources: 16% superphosphate, muriate of potash and $\frac{1}{3}$ each sodium nitrate, ammonium sulphate and cottonseed meal.

Results:

The Effects of Different Fertilizer Placements on Germination and Yield of Cotton when Fertilizers are Applied at Different Times

Fertilizer Placement (800 Lbs. of 4-8-4 per acre)	No. seedlings per acre before chopping*	Yield of Seed Cotton in Lbs. Per Acre
No fertilizer	42,380	768
Applied ten days before planting:		
Stirred and bedded on	39,104	1177
Not stirred and bedded on	35,226	1193
Seed in contact with fertilizer	29,448	1025
Applied at planting:		
Stirred and bedded on	26,652	1088
Not stirred and bedded on	21,128	1128
Seed in contact with fertilizer	17,196	903
In narrow bands 12" apart across beds, covered 3" deep	41,372	1134
4" to one side of seed by hand	38,300	946
Half bedded on at planting and half as top-dressing at chopping**	41,315	1159

Annual Proceedings, Nat. Fert. Assn.

*Four-year average.

**1930-31-32 only.

Reference: Agricultural Education Bulletin Volume 14, Numbers 5 and 6, pages 79 and 80, table 16, Clemson, South Carolina.

FERTILIZER PLACEMENT TEST WITH COTTON IN SOUTH CAROLINA

Conducted by: United States Department of Agriculture, the National Fertilizer Association and the South Carolina Pee Dee Branch Experiment Station.

Conducted at: Florence, South Carolina.

Period: 1930-1933.

Purpose: To determine the effect of fertilizer placement on the yield of cotton.

Soil: Ruston and Norfolk fine sandy loam.

Procedure and Conditions: One bushel of acid-delinted Coker's Super Seven cotton seed was planted per acre with an application of 800 pounds of 4-8-4 fertilizer. A specially constructed machine was used to apply the fertilizer and plant the seed. Stand counts are not available for all the years reported in these tests and only the placements used two years or longer are included.

Results:

Yield of Seed Cotton as Influenced by Fertilizer Placements

Fertilizer Placement (800 lbs. of 4-8-4 per acre)	Yield in Lbs. Seed Cotton Per Acre				
	1930	1931	1932	1933	Average
No fertilizer	1089	760	1858	1847	1388
In contact with seed	604	95	.....	.....	350*
1¾" band, 1" below seed	967	122	.....	.....	544*
1¾" band, 2" below seed	1376	371	1214	1335	1074
1¾" band, 3" below seed	1406	735	1453	1574	1292
3½" band, 1" below seed	1086	176	.....	.....	631*
3½" band, 2" below seed	1400	772	1338	1774	1321
3½" band, 3" below seed	1328	1017	1609	1974	1482
Mixed with soil under seed	1394	835	1514	1852	1399
Bands 1½" to each side**					
1" below level of seed	1410	1057	1668	2011	1536
2" below level of seed	1502	1147	1539	1951	1535
3" below level of seed	1648	1143	1684	2037	1628
Bands 3¾" to each side:					
1" below level of seed	1593	1097	1664	2061	1604
2" below level of seed	1555	1132	1706	2038	1608
3" below level of seed	1384	1285	1793	2017	1620

U. S. D. A. Circular 192 & 264; Annual Proceedings, Nat. Fert. Assn:

The experiment was run on Ruston fine sandy loam in 1930.

*Two-year average.

**In 1930 bands were 2¼" to each side.

Reference: Agricultural Educational Bulletin Volume 14, Numbers 5 and 6, page 71, table 2, "Fertilizer Placement Studies with Cotton and Tobacco," Clemson, South Carolina.

EFFECT OF APPLYING FERTILIZER AT DIFFERENT RATES AND PLACEMENTS IN TEXAS

Conducted by: Texas Agricultural Experiment Station in cooperation with Bureau of Agricultural Engineering, United States Department of Agriculture; the National Fertilizer Association; and the Joint Committee on Fertilizer Application.

Conducted at: Temple, College Station, and Nacogdoches, Texas.

Period: 1932-1935.

Purpose: To determine the effect of applying fertilizer at different rates and placements.

Soil: Houston black clay, Lufkin fine sandy loam and Norfolk sandy loam.

Houston black clay is black, very dark gray, or dark brown heavy clay. The subsoil is a yellowish-gray, greenish-yellow, or greenish-brown clay. In some areas both the topsoil and subsoil are highly calcareous. The surface soil is very plastic and tenacious when wet, but upon drying assumes an ashy color and crumbles to a desirable tilth if cultivated when moisture conditions are suitable. Rains cause a crust to form on the surface, but upon drying the crust cracks and crumbles sufficiently to permit the emergence of cotton seedlings.

Lufkin fine sandy loam is a grayish-brown or gray, rather compact, fine sandy loam underlain by a highly plastic and impervious clay subsoil. It has a smooth soapy feel and is sticky when wet but very hard and tough when dry. The soil has very slow underdrainage, and on smooth flat areas it remains wet for long periods. At a result, the soil warms up slowly in the spring. When dry it is rather difficult to work, and after rains a hard crust forms on the surface, making it difficult for cotton seedlings to emerge.

The Norfolk soils are gray on the surface with a yellow subsurface color. The top soil layers are friable or loose and merge below either with yellow friable sandy clay or loose very sandy material. The soils and subsoils are readily penetrated by water, and both surface and underdrainage are good. Even in the sandy loam a hard crust forms after rains, making the emergence of seedlings difficult.

Procedure and Conditions: The experimental plots at each location comprised about two acres of land that were divided into six blocks of about equal size and shape. All placements of fertilizer were systematically arranged in each block. Each plot, or placement test, consisted of a single row, usually about 125 feet in length. Each placement was repeated in each of the six blocks, or each placement was repeated six times. The row spacing varied according to the farm practice at each location. At College Station and Temple the row spacing was 36 inches. At Nacogdoches the spacings ranged from 39 to 41 inches between the rows. Records were taken from 100 feet of row, which was divided into two section. Therefore in making the

germination counts and calculating the yields, 12 sets of notes were secured, and these were added and the averages taken.

In the preparation of the seed bed, ridges were prepared according to the general practice of cotton farmers in the greater portion of the state. After the tests were planted and the seed were slightly above the general elevation of the soil. This permitted excess water during rain to drain into the depressions between the rows and prevented water from standing in the row and drowning out young seedlings.

In 1932 and 1933 three unfertilized checks were planted, but in 1934 and 1935 only two checks were planted, one for the placements under the seed and one for the placements to the sides of the seed. One of the checks had the soil stirred 1.75 inches wide and two inches under the seed, and thus served for a check for the placements under the seed. In another check the soil was left undisturbed for a distance of 3.5 inches to each side of the row. A third check, which was used only during the first two years, had the soil stirred three inches under the seed as though mixing the fertilizer with the soil.

Fertilizers: The fertilizer used in the machine placement studies with cotton was a 4-12-4 mixture purchased by the National Fertilizer Association on the local market and was typical of that used in farm practice. In 1932 and 1933 double strength fertilizer mixtures were used in the rate studies. The amount used was equivalent to 250, 500, and 750 pounds of ordinary strength 4-12-4 fertilizer. At the time of distribution the fertilizer was in good physical condition and drilled well.

Seed: An effort was made at each location to plant varieties of cotton that produced well. At Temple, Qualla cotton was used for the three years. The Startex variety was used each year at College Station. At Nacogdoches Lone Star was used in 1932 and 1933, Acala in 1934, and Startex in 1935. At all locations ordinary gin-run fuzzy seed were used each year. Each year at each location the cottonseed were treated with Ceresan at the rate of three ounces per bushell of seed.

Results: Effect on Yield of Cotton When 4-12-4 Fertilizer Was Applied at Different Rates and Placements

Fertilizer Placement	Pounds of Lint Per Acre														General Average
	Temple Houston Black Clay			College Station						Nacogdoches					
				Lufkin			Norfolk			Sandy Loam					
	1932	1933	Ave.	1932	1933	1934				1935	Ave.	1932	1933	1934		1935	Ave.
250 pounds per acre	264	355	310		243	298	209	434	296		272	165	213	215	274
Band 1.75" wide, 3" under seed							227	420	323			287	221	254	288
Band 1.5" to each side, 2" below seed level							213	463	338			265	204	234	286
Band 2.5" to each side, 2" below seed level	315	348	332		256	341			298					224	285
Band 3.5" to each side, 2" below seed level	284	348	316		249	332			290					221	276
Mixed with soil to a depth of 3" under seed															
500 pounds per acre	318	297	308		261	342	194	413	303		350	138	269	251	287
Band 1.75" wide, 3" under seed							210	400	305			195	271	263	284
Band 1.5" to each side, 2" below seed level							206	404	305			248	262	255	280
Band 2.5" to each side, 2" below seed level	329	411	370		266	379	222	474	335		328	208	265	260	322
Band 3.5" to each side, 2" below seed level	309	345	327		255	351	211	389	301		344	187	268	261	296
Mixed with soil to a depth of 3" under seed															
750 pounds per acre	304	237	270		255	303	199	388	286		315	141	382	275	279
Band 1.75" wide, 3" under seed							212	429	320			273	395	334	327
Band 1.5" to each side, 2" below seed level							225	482	353			295	354	324	339
Band 2.5" to each side, 2" below seed level	295	365	330		281	440			360					385	358
Band 3.5" to each side, 2" below seed level	310	371	341		278	431			354					341	345
Mixed with soil to a depth of 3" under seed															

Reference: Texas Agricultural Experiment Station Bulletin 548, pages 7, 8, 9, 13, 16 and 49, table 22, "Machine Placement of Fertilizer for Cotton, August 1937, College Station, Texas.

Growing Tung Trees In South Mississippi

South Mississippi Branch Experiment Station

J. C. ROBERT, Superintendent

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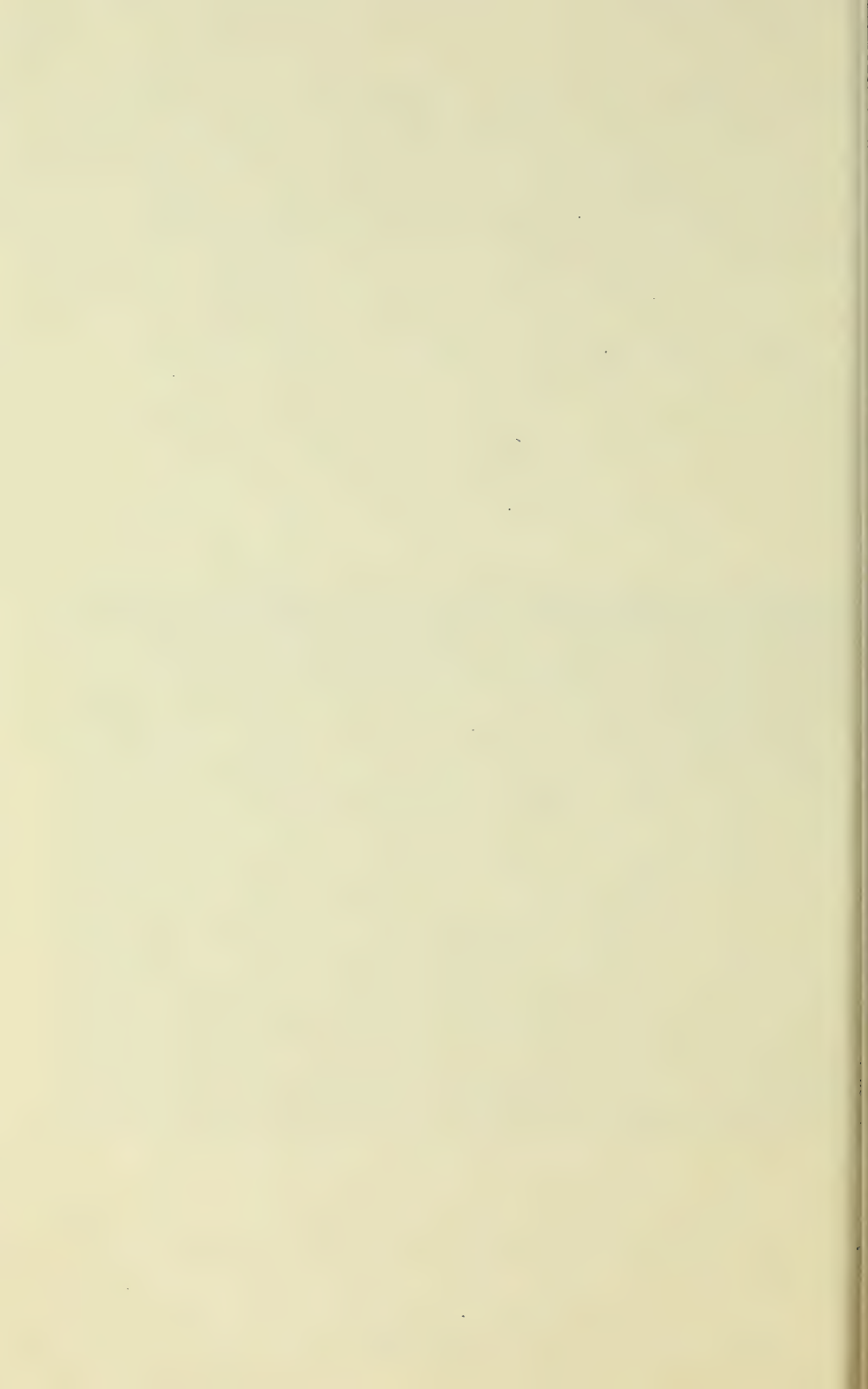


A WELL CARED FOR FOUR-YEAR-OLD TUNG GROVE

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION

State College, Mississippi

CLARENCE DORMAN, Acting Director



GROWING TUNG TREES IN SOUTH MISSISSIPPI

By J. C. Robert, Superintendent, and S. R. Greer, Assistant,
South Mississippi Branch Experiment Station,
Poplarville, Mississippi

INTRODUCTION

For many centuries tung trees have been grown in China, and the United States has been importing the oil for approximately fifty years. Imports of this oil increased until 1935 when they amounted to about 130,000,000 pounds.

In 1905 tung nuts were imported from China and planted in the Plant Introduction Gardens at Chico, California. Seedlings were later sent to the Gulf Coast States, from Florida to Texas. The earliest commercial tung grove in the United States was planted by the American Tung Oil Corporation in 1924 at Gainesville, Florida. This planting was financed by the National Varnish and Lacquer Association, Inc. The purpose of this planting was to study the practicality of producing tung oil in this country on a commercial scale. The first tung planting at the South Mississippi Branch Experiment Station was made in February, 1927.

It is estimated that there are more than 100,000 acres planted to tung trees in the Gulf Coast States at the present time. Plantings in Pearl River County, Mississippi, alone amount to about 70,000 acres. Other counties in Mississippi with more or less extensive tung groves are George, Stone, Hancock, Jackson, Harrison, Greene, Forest, Marion, Jones, Perry, and Pike. There are a few small plantings in other counties.

The purpose of this bulletin is to present certain facts obtained and observations made at this as well as other experiment stations. It is realized that there are many problems in the production of tung oil in this section which are not yet solved, but it is hoped that the information presented may aid in preventing future failures and serve as a guide for those wishing to invest in the growing of tung trees in Mississippi.

DESCRIPTION OF THE PLANT

The tung oil tree, *Aleurites fordii* Hensl., is also known as the Chinese wood-oil tree. There are several other common species: *A. montana*, *A. cordata*, *A. moluccana*, and *A. trisperma*. *Aleurites fordii* and *A. montana* are the only species grown to any extent for oil and meal production.

Aleurites fordii is the only species grown commercially in the United States. The leaves are large, heart-shaped (Fig. 1), occasionally three-lobed, and dark green in color. The flowers are borne in clusters (see frontispiece), are unisexual, appear before the leaves, and are white or tinted and striped with pink in the throat. As a rule one pistillate flower appears to each cluster and is surrounded by many staminate flowers. Trees of the so-called "cluster type" produce their fruits in clusters (Fig. 1). Perfect flowers are occasionally seen.

The fruit is two to three inches in diameter, is olive green in color, and turns dark brown at maturity. It contains three to seven seeds surrounded by a thick outer husk, the husk giving the fruit the appearance of a large walnut. The individual seed has a thin pellicle surrounding it and is more or less triangular in shape. The interior of the seed is white in appearance and is exceedingly oily. The oil is a violent purgative, which renders tung meal unsuitable for feed for livestock.

The tung tree is a semi-tropical plant. It has been known to withstand temperatures of 16 degrees F. without any apparent injury. The fruit buds, however, like those of many of our common fruits, are subject to injury if the temperature drops below freezing after they bloom in the spring.

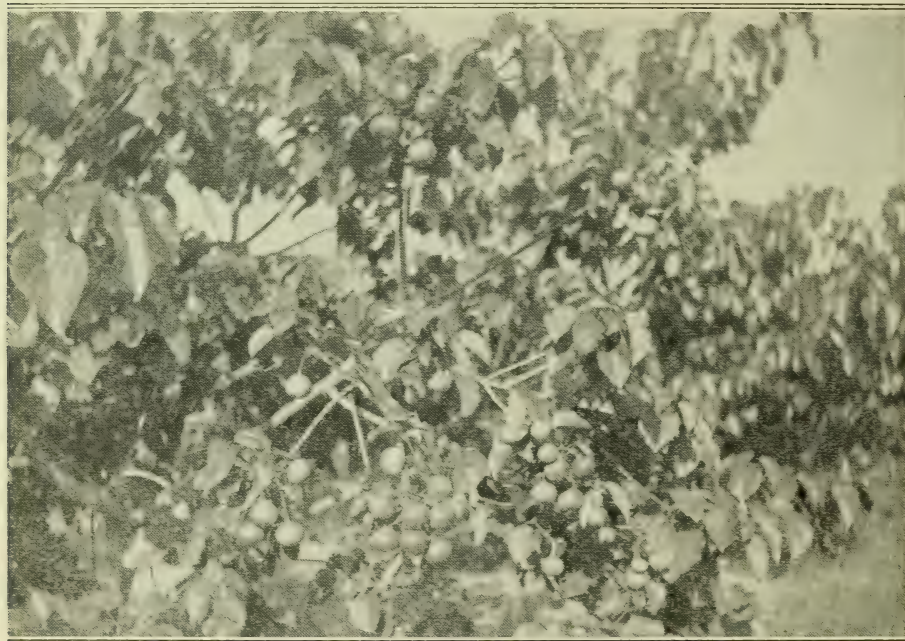


FIG. 1—CLUSTERS OF TUNG NUTS IN SIX-YEAR-OLD ORCHARD AT SOUTH MISSISSIPPI BRANCH EXPERIMENT STATION

RESULTS OF TESTS CONDUCTED AT THE SOUTH MISSISSIPPI BRANCH EXPERIMENT STATION

Cover Crops: These tests were designed to find the most economical method of producing the maximum per-acre yield of tung nuts of high oil content.

Plots of approximately 3/4 of an acre each were planted to tung trees the last of March and first week in April, 1932. The seedling trees used were secured from two nurseries located in Pearl River County, Mississippi. The plots were located on land much better adapted to reforestation than to growing tung trees. It had been abandoned for the growth of field crops and was very hilly and badly eroded. Most of the field was growing grass and weeds, but the gullied portion had been used as a dumping ground. Since this was the only land available at that time and represented some of the worst type of well drained land in this section, it was prepared for planting. The rubbish and remaining stumps were removed and the entire area broken with a disc plow. It was then terraced and the trees set upon the terraces, the distances between terraces varying from 16 to 25 feet.

A series of tests was planned to show the value of cover crops (both summer and winter) as soil building agents when grown on the land with tung trees. The following differential treatments were given: Plot A was grown to cow peas in summer, followed by Austrian peas in winter. This treatment was continued each

year for four years, at the end of which time the trees were shading the ground to such an extent that the treatment was discontinued. Plot B was planted to soybeans in the spring and turned under in the late fall. The third winter Austrian peas were used instead of Canadian field peas. Plot C received no cover crops but was cultivated twice during the growing season. Plot D was treated as Plot C except that no cultivation was given other than hoeing about 2 feet around the trees twice each year. There was no fertilizer given to any of the plots, but plots A and B received three and two cultivations respectively, that is, when each cover crop was plowed under.

Table I summarizes the results of these tests. Since there were no replications and since the soil was not sufficiently uniform for accurate results, definite conclusions cannot be drawn. Enough difference, however, was observed in the growth of trees and the yield of nuts to indicate that cover crops and cultivation pay in the young tung grove. Plot A produced approximately 44,000 pounds of green matter per acre from summer and winter legumes which carried about 330 pounds of nitrogen. Plot B produced only about half this weight of green matter (22,000 lbs.), the main difference being in the summer cover crop. Plot A had two crops of cow peas (three the first year) while Plot B had only one crop of soybeans. Comparing the various treatments, we see that both tree growth and yield are greater in Plot A. There seems to be a relationship between the amount of organic matter added to the soil by the cover crops and the growth and yield of the trees. Although cultivation without cover crops is better than sod culture, as show by the yield of Plot C, the yield being approximately ten times that of plot D, plot C did not produce nearly as high a yield or as large trees as either of the plots where cover crops were grown.

A point in favor of the cover crop treatments, one not shown in the table, is that two per cent of the trees in Plot C and 7.4 per cent in Plot D died. These

Table I—Comparison of Cover Crops and Cultivation, Clean Cultivation and No Cultivation. No Fertilizer Was Used On Any Plot. Trees Planted March, 1932.

Plot	No. of Trees	Cover Crops Grown	No. of cultivations per year	Diameter at Crown (in.)			Yield in lbs per acre	1936	1937
				1933	1934	1935	Gain in Diam.		
A	134	Cowpeas and Aust. peas	3	1.9	2.8	4.0	2.1	1313	0
		Soybeans and Can. Field P	2	2.0	3.1	3.9	1.9	893	0
C	73	None	2	1.3	1.8	2.7	1.4	391	0
D	108	None	0	.7	1.1	1.6	0.9	89	0

losses of trees are believed to be due to a weakened condition of the trees caused by the treatment given.

Cultivation and Fertilization: Three fertilizer treatments were given, only half the plots being cultivated. No cover crops were used in any of these plots. All trees were set April 1, 1934, being placed 20 feet apart on the triangle system. The cultivated plots received shallow cultivation every six to eight weeks during the spring, summer, and early fall. The land on which these plots are located is fairly uniform in fertility, slightly rolling, and of sandy loam type and may be classed as above the average in fertility, being superior to the cover crop plots.

Table II summarizes the results of this series of tests, and figure 2 shows the contrast between cultivated and uncultivated trees. It will be observed that all cultivated plots produced a crop of nuts in both 1936 and 1937, while the uncultivated plots produced only a light crop in 1936 and none in 1937. Fertiliza-

tion increased production in the uncultivated plots, but this production was much less than that of the cultivated but unfertilized plots. The uncultivated plots were grown in lespedeza sod.

Another interesting fact observed in the cultivated plots was their ability to withstand more severe spring frosts. The late spring frost in 1937 killed all of the crop on trees just across a field road from these plots on land very similar in

Table II—Comparison of Cultivated With Uncultivated Trees, and Fertilizer With No Fertilizer.
Trees Planted April 1, 1934

Plot	No. of Trees	Fertilizer Treatment Pounds per Tree	Cultural Treatment	Yield per Acre	
				1936	1937
E	93	None	Clean Cultivated	1132 lbs	313 lbs
F	94	50 lbs. stable mature 1 lb. Nit. Soda for each year since planting	Clean Culutivated	976 lbs	640 lbs
G	79	None	Clean Cultivated	1203 lbs	501 lbs
H	14	None	Not Cultivated	1.7 lbs	None
I	12	50 lbs. stable manure 1 lb Nit. Soda for each year since planting	Not. Cultivated	9.7	None
J	11	None	Not Cultivated	11.3	None



FIGURE 2—FOUR-YEAR-OLD SEEDLING TREE OF UNIFORM SIZE WHEN SET APRIL, 1934
TREE IN FOREGROUND GROWN IN SOD, OTHERS CULTIVATED

every way to the land of these plots. The elevation was practically the same in each case. It seems that a grove well fertilized and cultivated is able to withstand lower temperatures in the winter and also spring frosts.

ESTABLISHING THE GROVE

In establishing a tung grove one of the important problems is that of securing good trees to plant. At present most of the plantings are made with seedling

trees. When this practice is followed, one should try to get trees grown from seeds selected from trees of high productivity and other desirable characteristics. As a rule, the best method is to grow these plants, but they may be purchased from a reliable nurseryman.

Land for growing nursery stock should be fertile and well drained. It should be well prepared by plowing, discing, and bedding to four-foot rows. When available, stable manure should be added at the rate of 12 to 15 tons per acre, but if not available 800 to 1000 pounds of a good grade of commercial fertilizer will serve the purpose. In either case apply fertilizer in the furrow and bed upon it. When ready to plant the nuts (January and February), open the top of the row with a shovel plow to a depth of about four inches. Plant seed of the previous season's crop about 2 to 3 feet apart, cover with a harrow, and run a cultipacker or drag over the rows. If the seed are soaked in water for 24 to 36 hours before planting, germination will be hastened. During the germination period the soil should not be allowed to bake and thus form a hard crust. The young seedlings are very tender during the germination period, therefore, care should be taken not to injure them during the cultivation.

Cultivation should be given at frequent enough intervals to keep down all weeds so that the seedlings may make rapid growth. If stunted in the nursery row, the

FIGURE 3—THRIFTY TUNG TREE NURSERY STOCK AT SOUTH MISSISSIPPI BRANCH EXPERIMENT STATION, SEVEN MONTHS FROM SEED.



seedlings cannot be expected to make as good orchard trees as desired. Figure 3 illustrates a well-cared-for nursery row and shows the growth one may expect the first year. We have budded a number of seedlings, but they have not yet come into bearing.

Although the tung trees may be successfully transplanted any time during the dormant season, it is better to transplant as early as possible. The nursery trees are

usually dug with spades, care being taken to remove as much of the root system as possible and to leave 15 to 18 inches of the tap root on the plant. Only the more vigorous and healthy plants should be used. All seedlings showing injury from nematodes or insects and diseases should be discarded.

The following information may prove of value for those purchasing tung nuts for planting: One bushel of fruits weighs about 30 pounds and one bushel of hulled seed about 42 pounds. The dried fruits run about 56 per cent seed and 44 per cent hulls. There are about 125 seeds per pound and about 2,000 seeds per bushel of fruit.

Figure 4 shows an orchard planted 20 feet apart with the limbs meeting at four years of age. On good land permanent tung trees should be planted approximately 30 feet apart. Temporary tung trees may be placed at equal distances between these and removed when too crowded, that is, from 4 to 6 years. Various systems of laying out the orchard may be used, but the square, triangle, and contour systems are those most commonly used. Directions for laying out and planting an orchard by these methods may be had by writing the Mississippi Experiment Station for Information Sheet No. 28. The triangular system gives most trees per acre and the contour the least.

Holes should be dug large enough to accommodate all roots without undue crowding. The tree is placed in the hole to about the same depth that it grew



FIGURE 4—FOUR-YEAR-OLD TREES SET 20 FEET APART. NOTE CROWDING

in the nursery row, the roots are spread in as nearly as possible the position in which they formerly grew in the nursery row, and mellow top soil is sifted around them. The soil should be well firmed around the roots. After the hole is filled to within three or four inches of the surface soil, barnyard manure or commercial fertilizer may be added and worked in with the remaining soil required to fill the hole. Fertilizer should never be placed in direct contact with the roots. When

placed above the roots it will be taken down to them by the rains and the plant will be benefited without danger of root injury. The fertilizer may be added to and worked into the surface of the soil after the trees are set. If a gallon or two of water is siphoned into the hole before replacing of the last 2 inches of soil, it will cause soil particles to settle closely around the roots, thus preventing air-pockets and increasing the chance of life for the seedling. This precaution should not be necessary except when planting is made in dry soil late in the winter and early spring.

In the selection of land on which to plant tung trees the following soil conditions should be avoided: (1) a soil in which the water table is within 12 to 15 feet of the surface of the ground, (2) a soil underlaid with hard impervious sub-soil or one in which pipe clay predominates, (3) distinctly alkaline soils, (4) very poor soils, unless fertilization is to be practiced, (5) land which has not been sufficiently cleared to allow thorough cultivation, and (6) soils infested with insects and diseases affecting tung trees. Dr. Clarence Dorman, of the Soils Department and Acting Director of the Mississippi Agricultural Station, who has inspected some of the tung plantings in South Mississippi, rates the value of soil types inspected for tung plantings as follows: (1) Ruston fine sandy loam, (2) Norfolk, (3) Caddo, and (4) Susquehanna. He had not seen tung trees growing on Orangeburg soil, but thinks it may rank with Ruston fine sandy loam soils.

MANAGEMENT OF THE TUNG GROVE

The cost of preparing the land before planting the grove will vary with the nature of the land, stumps to be removed, nature and amount of vegetation, etc. The price paid for average cut-over pine land is a comparatively small cost of the final expenditure for the proper preparation of the land for planting the trees. Removing stumps and surface roots, clearing underbrush and plowing, discing, and terracing the land (on rolling land) are expensive. The cost of this work, including planting the trees, will vary with the condition of the land. This cost has been variously estimated at from \$15 to \$30 per acre.

The growing of tung trees is not a reforestation problem and should not be treated as such. The trees, like any other agricultural crop, respond well to cultivation and fertilization. While the trees are young, care should be taken to prevent competition from weeds and grasses (Fig. 5). Shallow cultivation should be practiced, and if the contour of the land will permit, cross cultivation should be practiced.

It is advisable to plant some crop between the rows for the first 3 or 4 years after setting tung trees. If the trees are spaced 30 feet apart one can plant five to six three-foot rows of some annual crop, leaving a five-foot strip on either side of the trees to be clean cultivated. If some legume crop, such as peanuts, *croton spectabilis*, soybeans, or cow peas, is grown and only the seed harvested, the remaining parts of the plants may be turned under, thereby aiding in maintaining the fertility of the soil. Some winter legumes, such as Austrian peas, Canadian field peas, vetch, or crimson clover, should be grown and turned under each spring. If one wishes to use only summer and winter cover crops, *croton* and vetch or bur clover may be used broadcast. If these crops are allowed to seed before being turned under, they will reseed themselves each year. After the fourth or fifth year the trees should be of sufficient size to shade the ground to such an extent that intertillage will not be advisable.

When the nursery tree is set out it should be headed back rather severely. The practice has been to head at 8 to 12 inches. After growth begins in the spring all shoots except one should be rubbed off so that there will be only one trunk developed. After this pruning there is little further pruning to be done

except removing crowded or broken branches. The surface of all larger cuts should be painted to prevent rot. From this single body the tree should begin branching 3 to 5 feet from the ground and should be allowed to form two or three branches at this height, but the main trunk should continue to form three or four other side branches at higher levels. Some growers allow the tree to throw several branches from the ground, thus forming trees with several trunks. As a rule, this is a result of improper planting. The tree dies back to the roots, but later sends out several shoots from the ground level. After such trees are six to ten year old, their trunks are crowded to such an extent that some are likely to be blown down or otherwise destroyed. One of the main advantages of heading the tree 3 to 5 feet above the ground is that one can cultivate close to the tree with ease. The cover figure shows trees headed at the proper height, while figure 6 shows a tree with several trunks.



FIGURE 5—A WELL CARED FOR TUNG ORCHARD DURING THE FIRST GROWING SEASON.
PROPERTY OF U. B. PARKER, WIGGINS, MISS.

If the weeds and grasses are kept down, the harvesting of the crop is a comparatively simple matter. The nuts usually fall to the ground by the middle or last of November. In dry weather they are gathered in baskets or sacks, hauled to the seed house, and stored on slatted frames. The storage house should be well ventilated to allow proper drying of the nuts. When well dried they are ready for market. The grazing of bearing tung groves after the fourth or fifth year is recommended since this keeps down grass and weeds and thus facilitates harvesting the crop, besides furnishing pasture for livestock. Since animals will not eat the plant or fruit, there is little danger of their causing much injury to the bearing tree of this age.

A serious condition found among tung trees in South Mississippi has been the so-called "winter killing," a condition induced in part by cold weather. The

symptoms are pronounced early in the spring and are characterized by the dying of the bud-wood and by destruction of many twigs extending from terminal buds and often including the entire limb. In some cases young trees are killed. In practically every case of this injury, bark on the southeastern side of the tree is broken open. This has caused alarm among some of our tung growers. We have had this condition in our Station plantings, but have never found it in any orchard that had been properly cultivated and fertilized. Well nourished trees have a far better chance to withstand all hazards than trees given poor care. Low undrained areas should be avoided. (Figure 7).

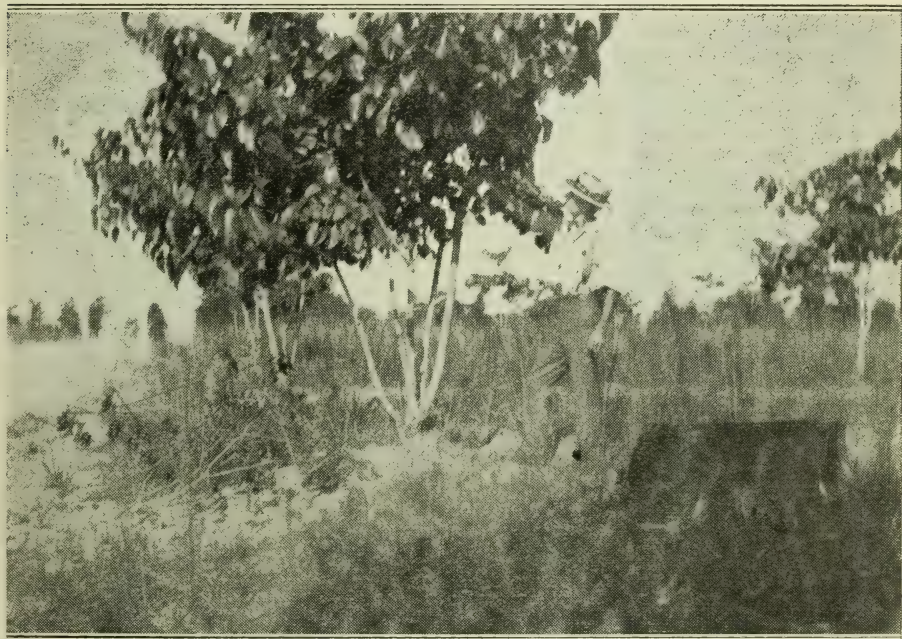


FIGURE 6—MULTIPLE TRUNK TUNG TREES. IMPROPER SETTING CAUSED THE TREES TO DIE TO THE ROOT FROM WHICH SEVERAL SPROUTS WERE ALLOWED TO GROW.

DEMAND AND USE

The United States now uses from 75 to 80 per cent of the world's production of tung oil, but has never grown more than two per cent of that used. In 1935 the United States imported approximately 130,000,000 pounds of this oil, while only about 2,000,000 pounds were produced in the United States. The cost of the imported oil was between 15 and 20 million dollars. On the New York market the oil produced in the United States sold at a premium of two to four cents per pound over Chinese produced oil.

Most sales of tung oil made in the past few years have brought from ten to fifteen cents per pound. Recently one firm offered thirty cents per pound for 10,000,000 pounds of this oil, and when last heard from was unable to get the order filled. One shipment recently made from Poplarville, Mississippi, sold for 24½ cents per pound.

If mature trees produce a ton of fruit (20% oil) per acre (they should produce 1½ to 2 or more tons), 325,000 acres would be required to produce the volume of

oil imported in 1935. This estimate does not reckon with the new uses being found for the oil. So it seems reasonable to expect the demand to increase. We have a potential market for the production from a large acreage of tung trees in the Gulf Coastal region.

It is claimed that tung oil is used in the production of at least a hundred articles of commerce. The following are a few purposes for which it is used: paints, varnishes, automobile top-dressing, brake linings for automobiles, wood preservatives, insulating materials, umbrellas, water bags, boat caulking, and water-proofing of clothing.

Tung meal, like cottonseed meal, is made from the compressed cake after the oil is removed. Chemical analyses have shown that it contains approximately the same percentage of nitrogen as does cottonseed meal. This Station has conducted a series of fertilizer tests comparing tung meal with cottonseed meal as a source of nitrogen. These preliminary tests indicate that tung meal is as good a source of nitrogen as is cottonseed meal.



FIGURE 7—RESULTS OF PLANTING TUNG TREES ON A POORLY DRAINED SOIL

YIELDS OF OIL TO BE EXPECTED

Mr. J. B. Wright, of Cairo, Georgia, has the following to say concerning the yields one may expect from tung orchards:

"The following yields of nuts, based on my own experience and careful observations, are given as what may be reasonably expected per acre from tung nut orchards well cared for on good land:

"Third year from setting.....	300 lbs.
Fourth year from setting.....	700 lbs.
Fifth year from setting.....	1400 lbs.
Sixth year from setting.....	2000 lbs.

Seventh year from setting.....	3000 lbs.
Eighth year from setting.....	4000 lbs.
Ninth and succeeding years.....	4000 lbs. to 6000 lbs."

It should be remembered that these estimates are based on growing tung trees on good land which has received the proper cultivation, fertilization, etc. Since the oil content will run about 20% of the total yield of dried fruit, one can estimate the possible returns that may be expected. It may be stated here that the oil content of fruits from different trees varies greatly. Unpublished data* shows a variation of from 17 to 25 per cent oil in fruits collected from different trees, which demonstrates the great need for standard varieties.

SUMMARY

1. The tung tree is a semi-tropical plant, but is able to withstand temperatures as low as 16 degrees F. when dormant.
2. Late spring frosts may cause considerable damage to the crop when the trees bloom too early.
3. Tung trees should be planted on well drained land that is fertile or can be made so by fertilizers.
4. If seedling trees are to be planted, the seed should be selected from high producing trees with fruit of high oil content.
5. A strip of land five or six feet on either side of the trees should be clean cultivated for three to four years.
6. On good land trees should be set at least 30 feet apart. Temporary trees may be set between the permanent trees, but should be removed when crowding begins.
7. The tung grove may be pastured after the fourth or fifth year.
8. Care should be taken to select a soil type adapted to the growth of tung trees.
9. Trees should be trained to a single trunk and headed when three to five feet high.
10. There is a great variation in tung trees both in total production and in oil content of the fruit.

*Analyses made by J. E. Knapp and R. E. Price, Crosby Naval Co., Picayune, Miss. Fruits collected by M. G. Carlton, Crosby Naval Co., Picayune, Miss.



